



## SRW Applications & Technical Specifications

# Agenda



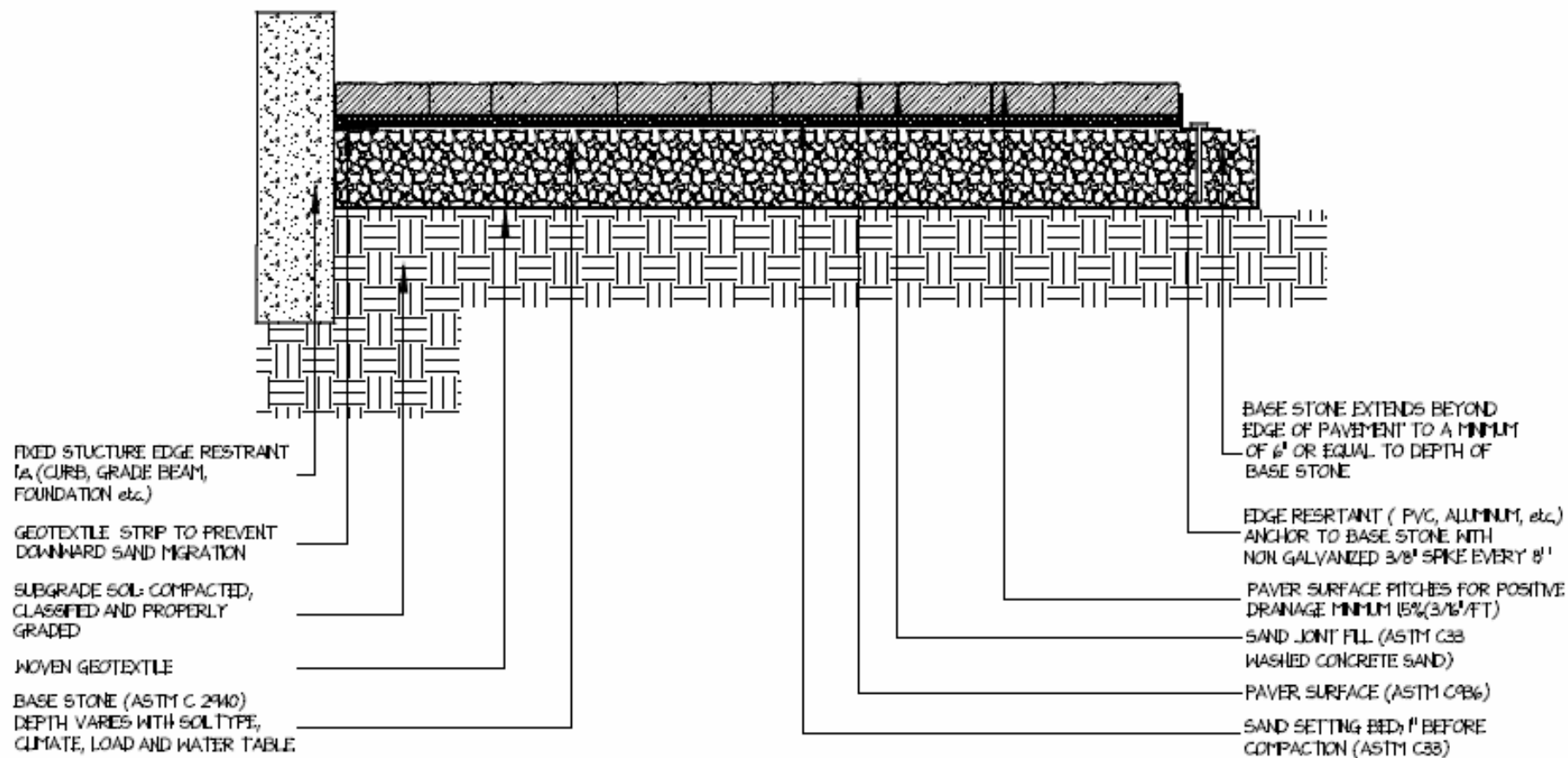
- Introductions
- Hardscape Systems
- Walls
- NCMA & Resources
- SRW applications and benefits
- Trends
- SRW Competitors
- Performance
- Codes/Specs
- Geotextiles & Geogrids

# Introductions



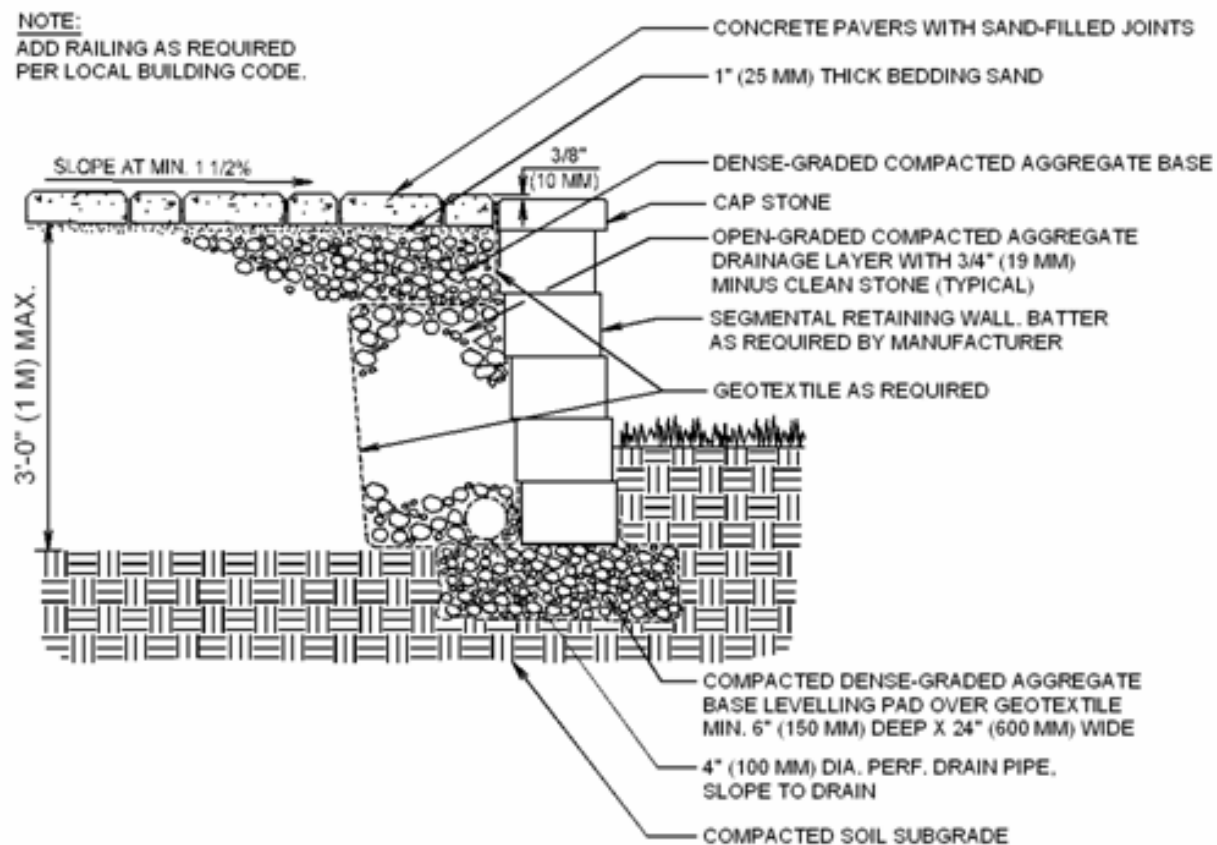
- Techo-Bloc
  - Leading manufacturer in Northeast US and Canada
  - Celebrating 20<sup>th</sup> Year
  - Only manufacturer to offer:
    - Lifetime, transferable warranty
    - De-Icing Salt resistance
    - Meeting/Exceeding all Canadian, QC, and US stds
    - Color through & through on all products

# Interlocking Paver Systems

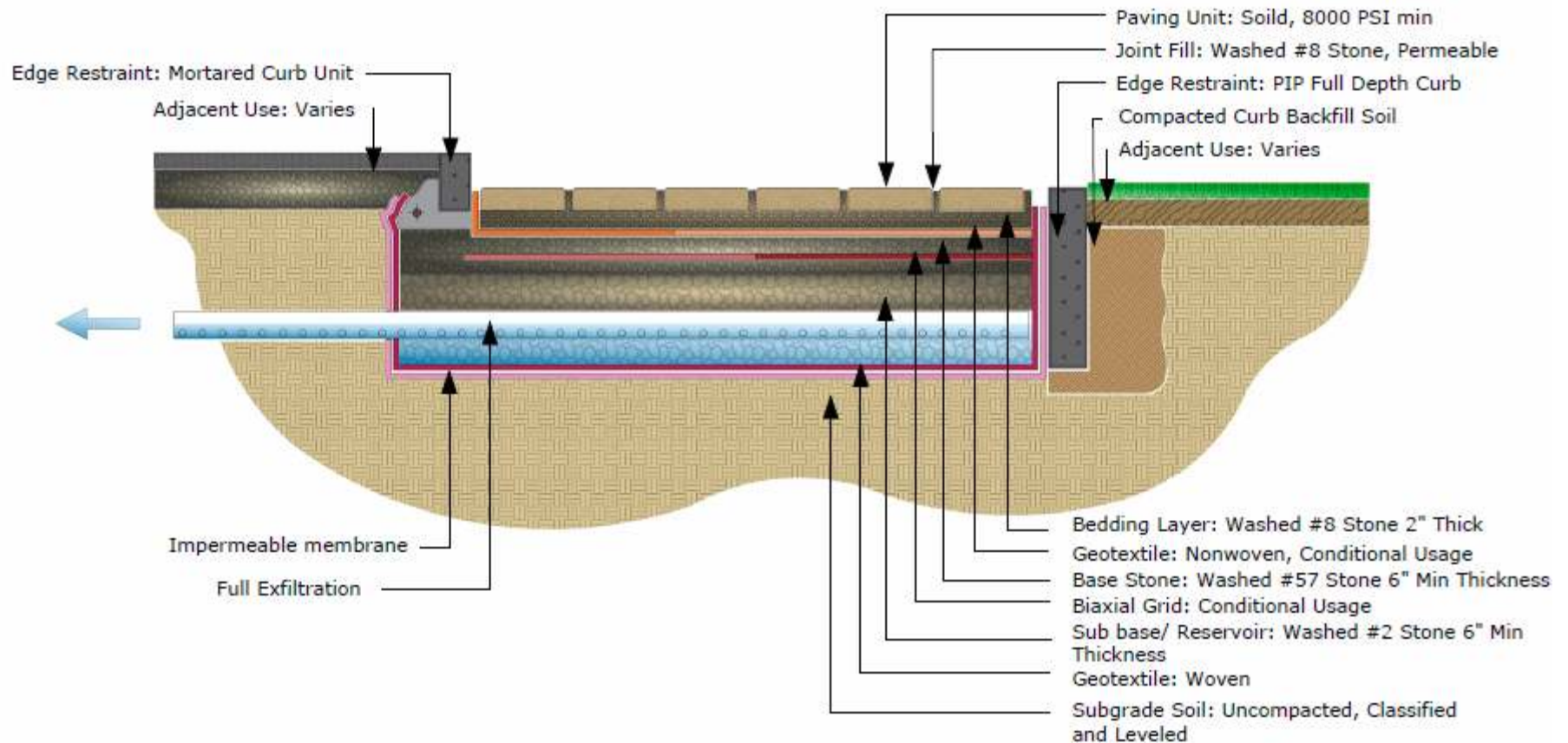


PLEASE CONSULT [www.techo-bloc.com](http://www.techo-bloc.com), YOUR TECO-SPECS LITERATURE, OR CONTACT YOUR LOCAL TECO-BLOC SALES PROFESSIONAL FOR ADDITIONAL QUESTIONS

# Raised Patios



# Permeable Pavement Systems



# Wall Failures



# Wall failures



# Wall failures



# Wall failures



# Wall failures



# Wall failures



# Tiered walls?



# The Answer???



# The Answer???



# Small walls, too!

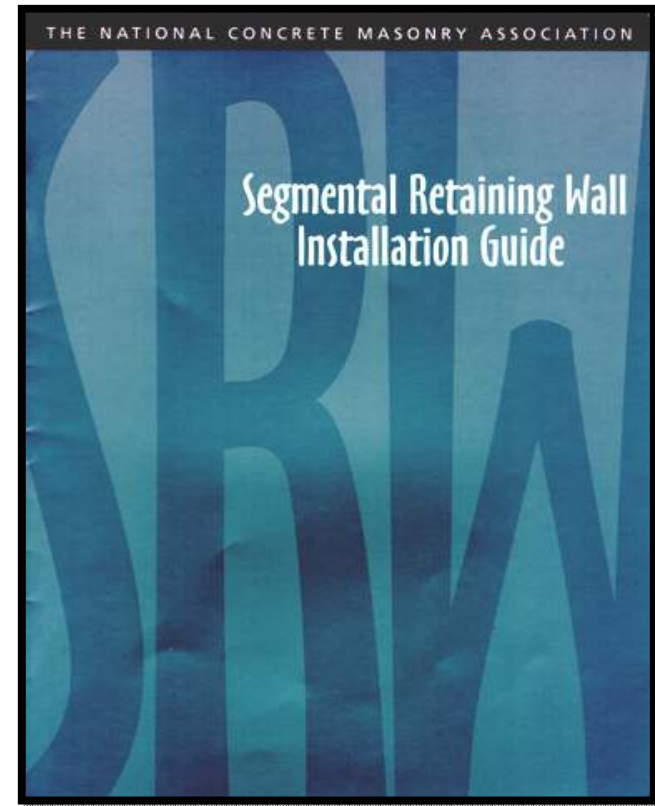


- National Concrete Masonry Association
  - Founded 1918
  - 6 Regions within United States and Canada
    - International and professional representation
  - Producer Member Representation
    - Standard Block
    - Architectural Block
    - Articulating Concrete Block
    - Segmental Retaining Wall Units

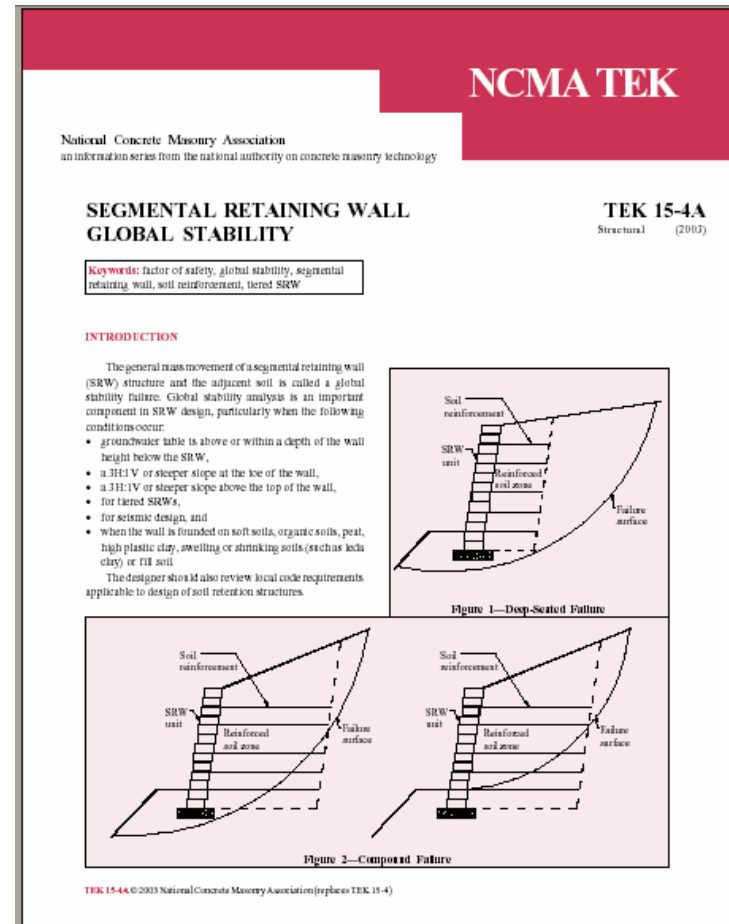
- Participation and Monitoring of Industry Fora
  - Standards Development
    - ASTM International
    - American National Standards Institute (ANSI)
    - International Standards Organization (ISO)
  - Design Code Development
    - International Building Code
      - ANSI / NCMA SRW Standards Committee
        - » ANSI Accredited - Standards Developer Organization for mortar-less concrete
    - Masonry Standards Joint Committee – ACI 530

- Segmental Retaining Wall Resources
- Education Courses and Certification Programs
- Codes and Standards
- Performance and Design Research and Testing
- SRW Unit Durability Research
- Segmental Retaining Wall Marketing
- NCMA Committees

- Construction
  - TR-146, Segmental Retaining Wall Installation Guide (2002)
  - TR-159, Inspection Guide for Segmental Retaining Walls (1996)



- NCMA TEK
  - TEK 15-4A, Segmental Retaining Wall Global Stability
  - TEK 15-5, Segmental Retaining Wall Design
  - TEK 15-8, Guide to Segmental Retaining Walls



- NCMA Research and Development Laboratory
  - SRW Unit Compliance Testing
  - Freeze-Thaw Research
  - SRW Connection and Shear Testing



- Certified SRW Installer™  
(CSRWI™) Certification Program
  - Eligibility requirement: 6 hours of SRW-installation education
  - Certification exam: Knowledge of fundamental SRW structural performance principles and installation practices

# SRW History



- 2,500 – 3,000 years
  - Ziggurats of Babylonia pioneered soil reinforced methods
    - Tree branches and fabrics
  - Great Wall of China
    - Reinforce Tamarisk branches
- Concrete wall units
  - Introduced in 1960s
  - mid-1980s became prominent



SRWs

# SRW - Defined



- Earth retention wall comprised of dry-stack, modular concrete block units and compacted soil fill with or without the inclusion of soil reinforcement.
- Two types:
  - Conventional gravity retaining wall
  - Geosynthetic reinforced soil retaining wall

# SRW applications



- Landscaping walls
  - Planters, flower beds, accents
- Structural walls for grade separation
- Waterway channelization and retention
- Parking lot support
- Roadway and highway structures



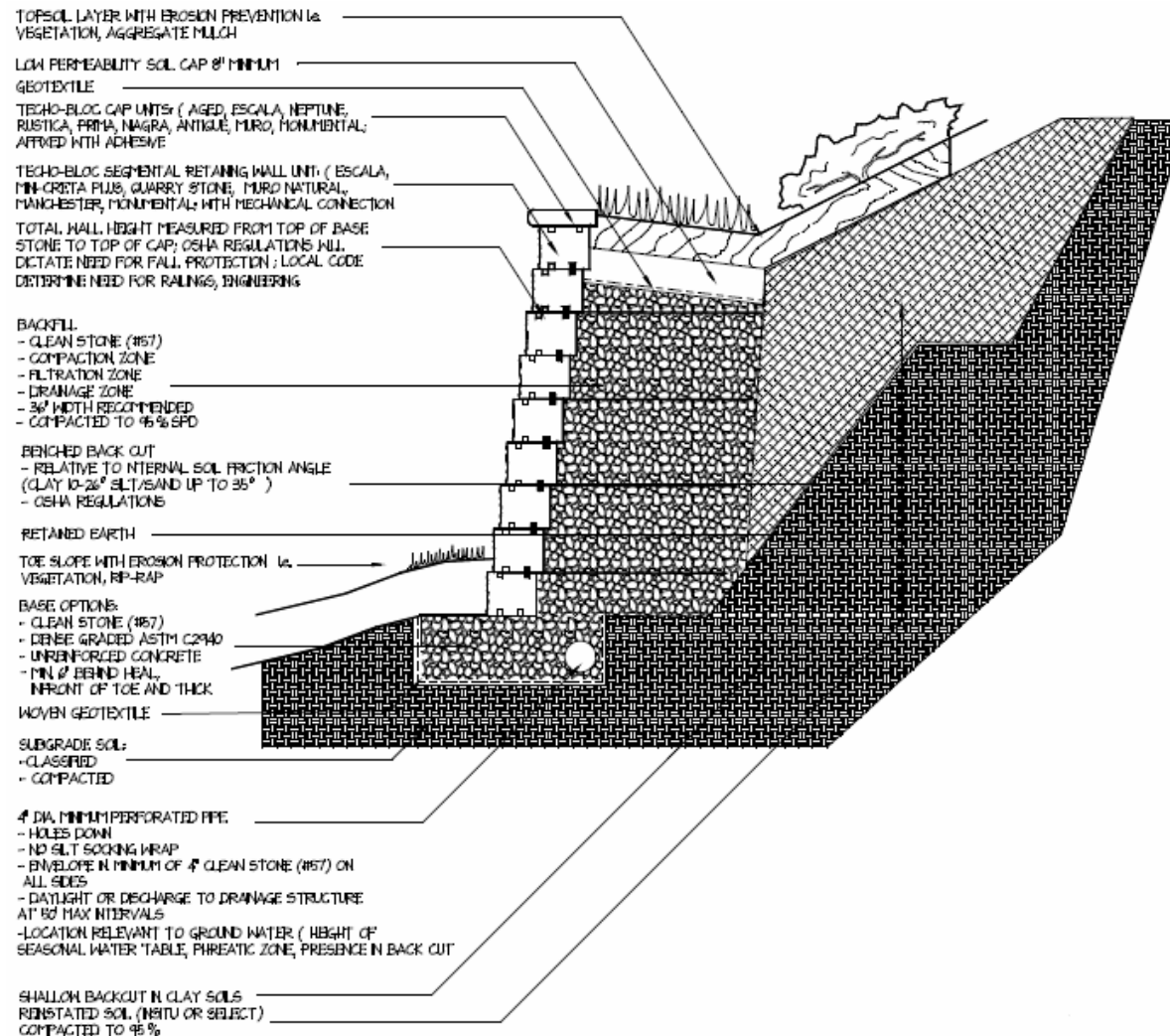
Gravity Walls

# Gravity Walls



- Unit mass to support structure
- No soil stabilization or re-inforcement

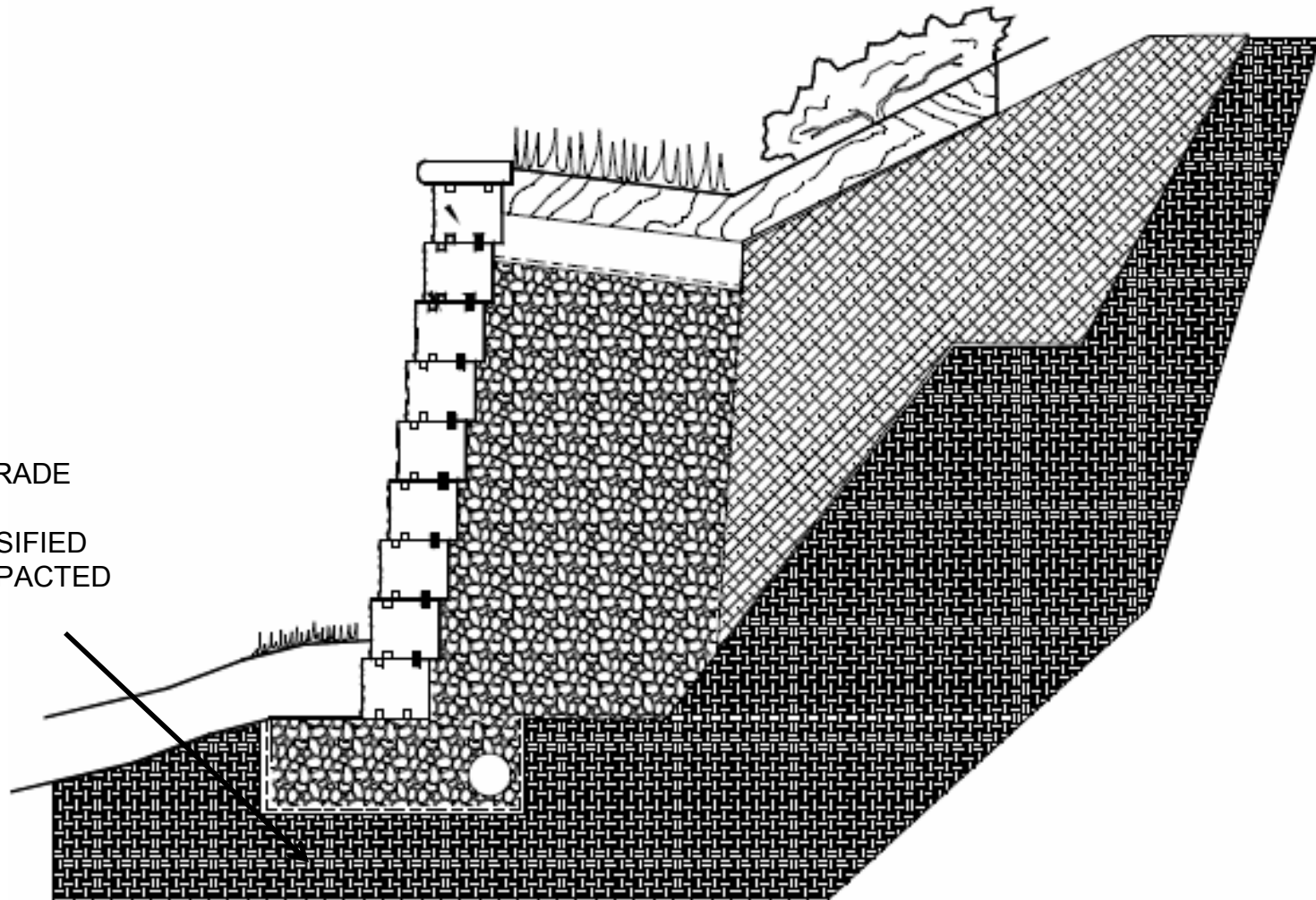
# Gravity SRW



# Gravity SRW



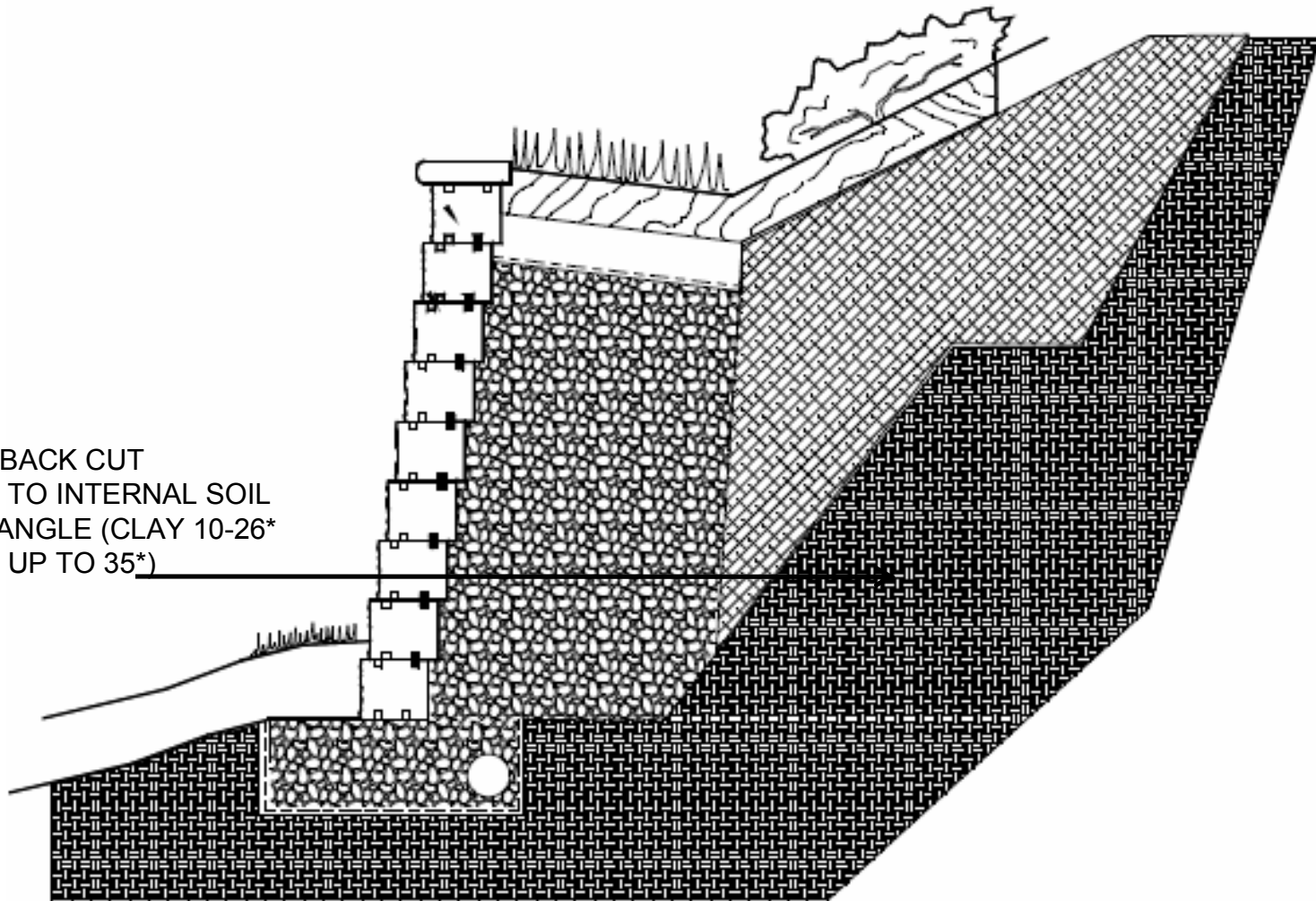
SUBGRADE  
SOIL:  
-CLASSIFIED  
- COMPACTED



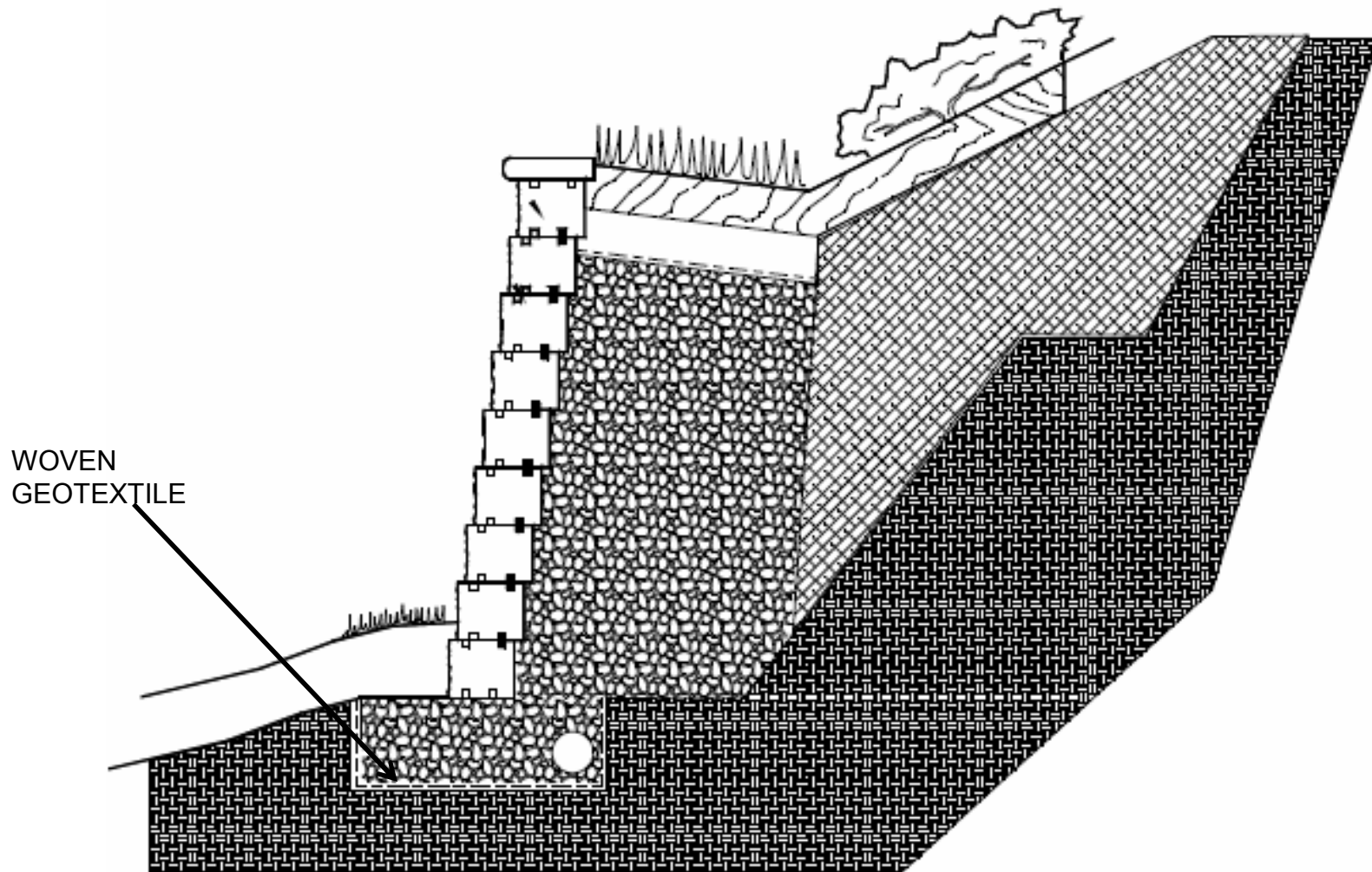
# GRAVITY SRW



BENCHED BACK CUT  
-RELATIVE TO INTERNAL SOIL  
FRICTION ANGLE (CLAY 10-26\*  
SILT/SAND UP TO 35\*)



# GRAVITY SRW

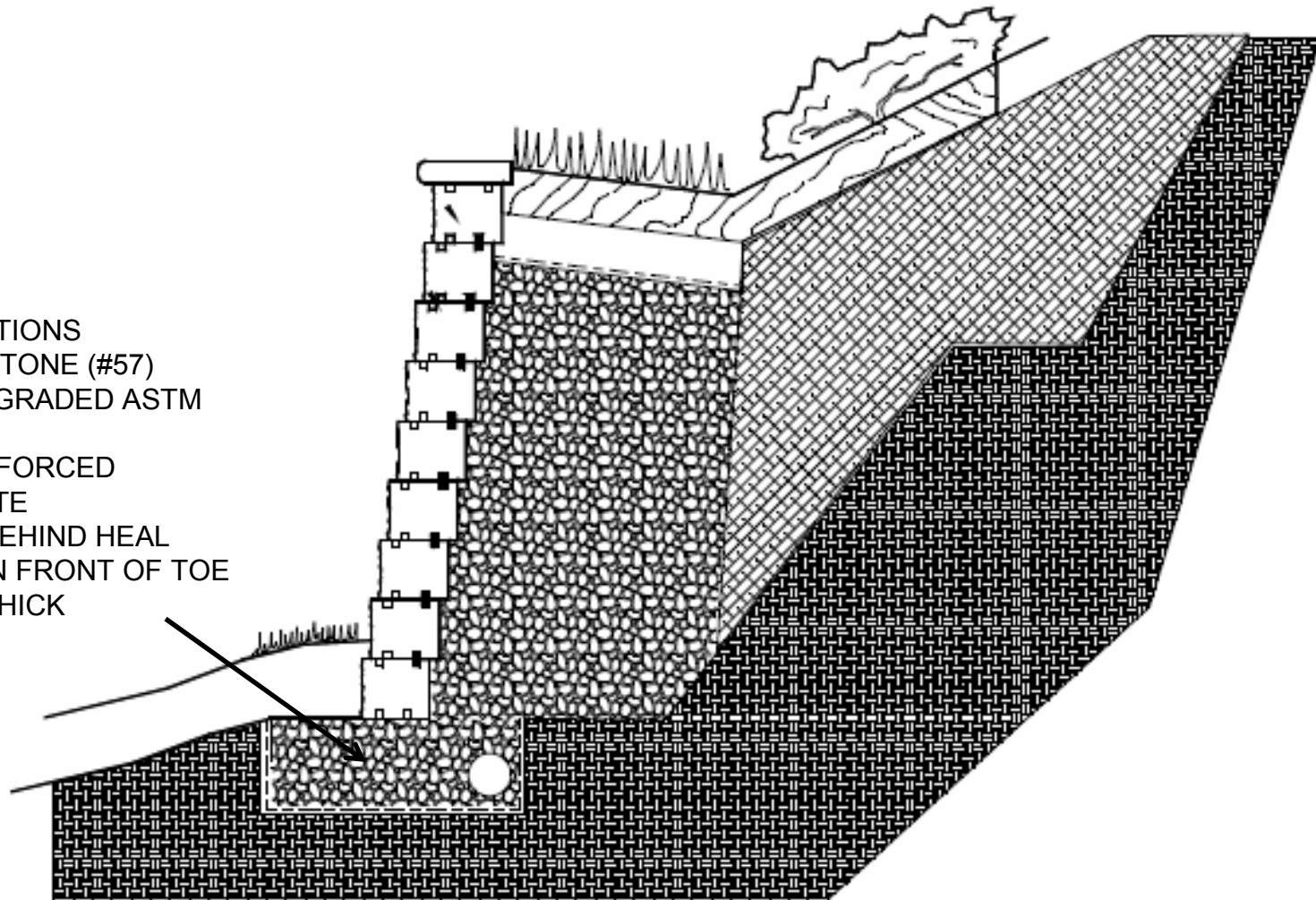


# GRAVITY SRW



## BASE OPTIONS

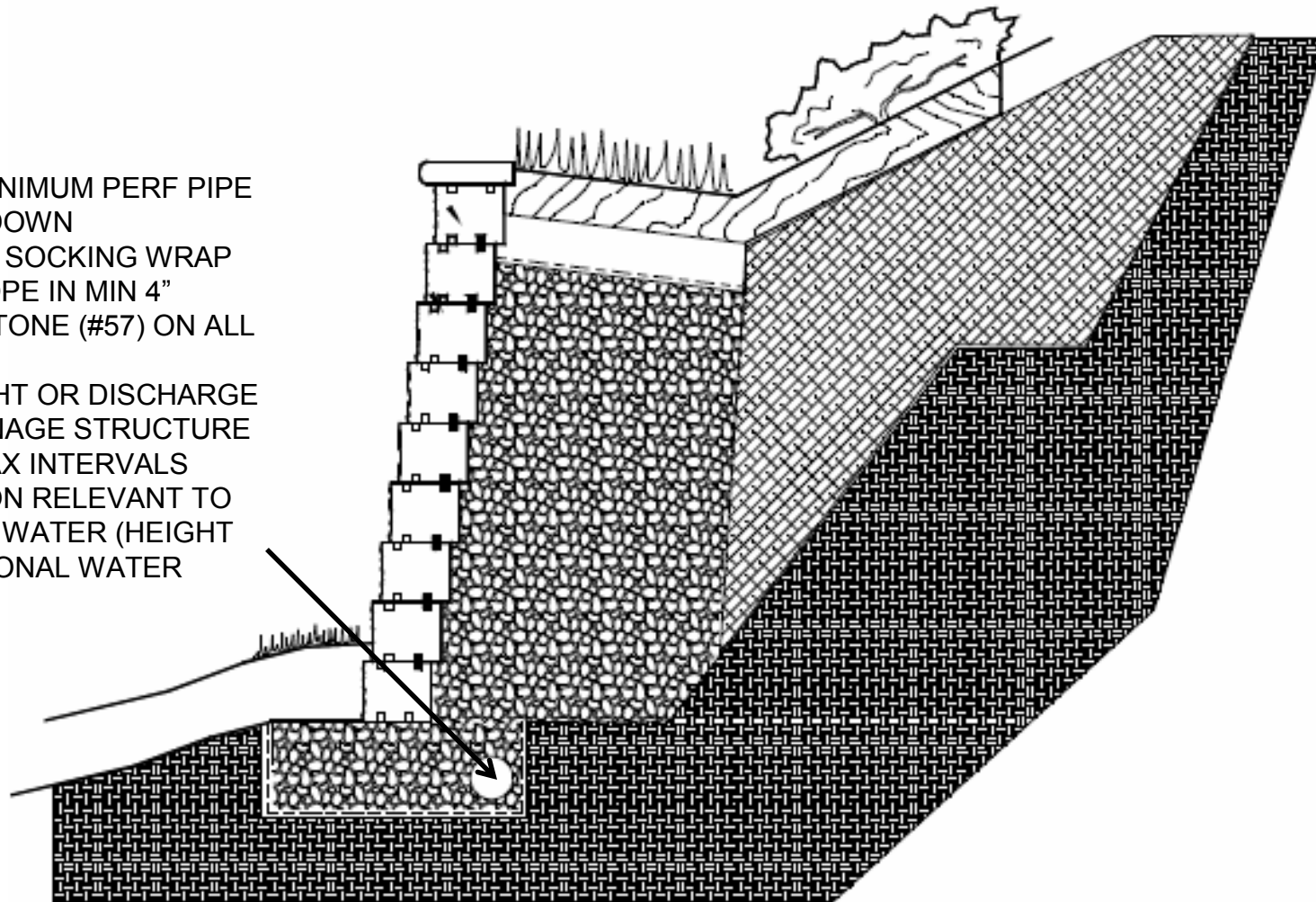
- CLEAN STONE (#57)
- DENSE GRADED ASTM C2940
- UNREINFORCED CONCRETE
- MIN 6" BEHIND HEAL
- MIN 6" IN FRONT OF TOE
- MIN 6" THICK



# GRAVITY SRW



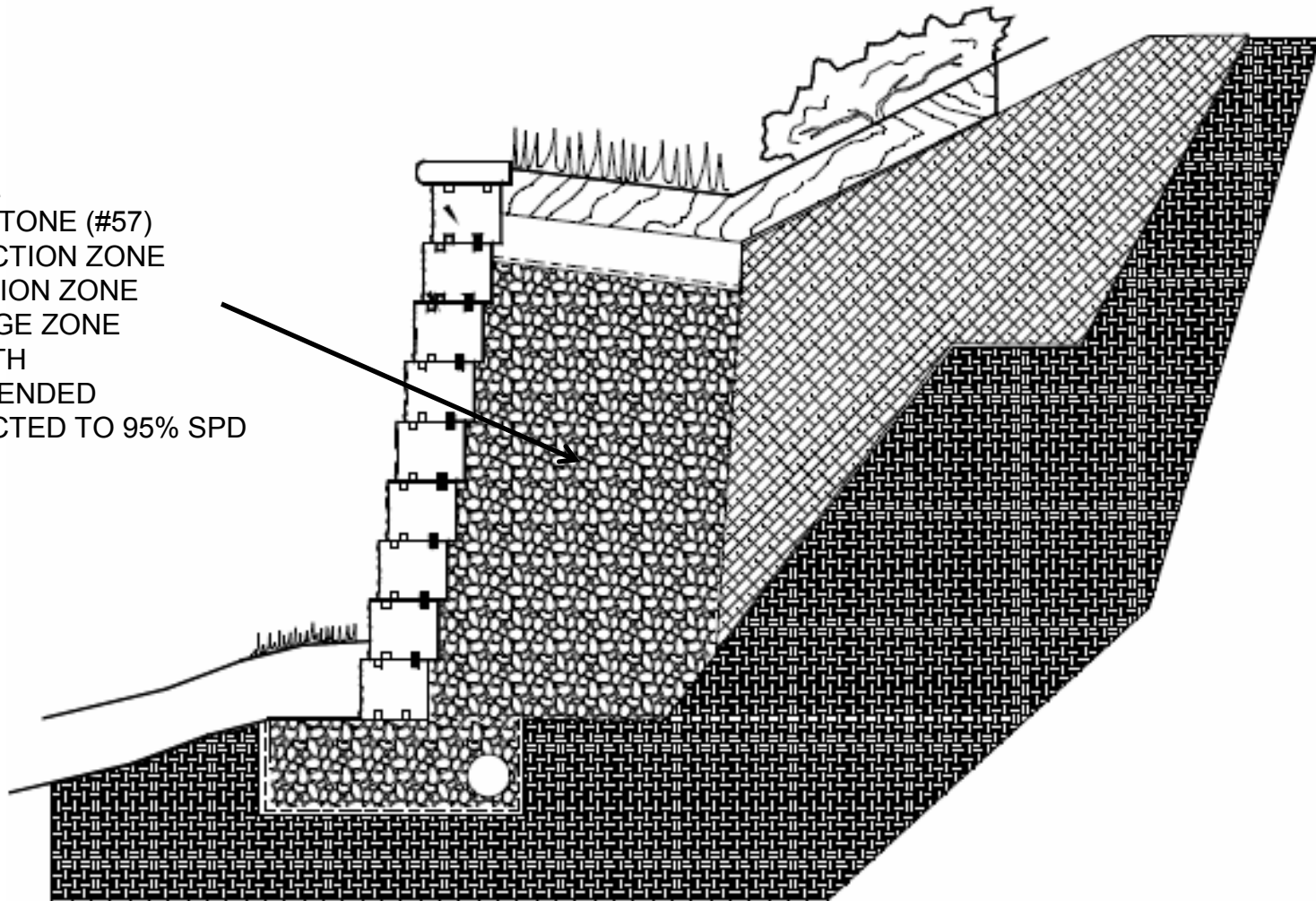
- 4" DIA. MINIMUM PERF PIPE
- HOLES DOWN
- NO SILT SOCKING WRAP
- ENVELOPE IN MIN 4"
- CLEAN STONE (#57) ON ALL SIDES
- DAYLIGHT OR DISCHARGE TO DRAINAGE STRUCTURE AT 50' MAX INTERVALS
- LOCATION RELEVANT TO GROUND WATER (HEIGHT OF SEASONAL WATER TABLE)



# GRAVITY SRW



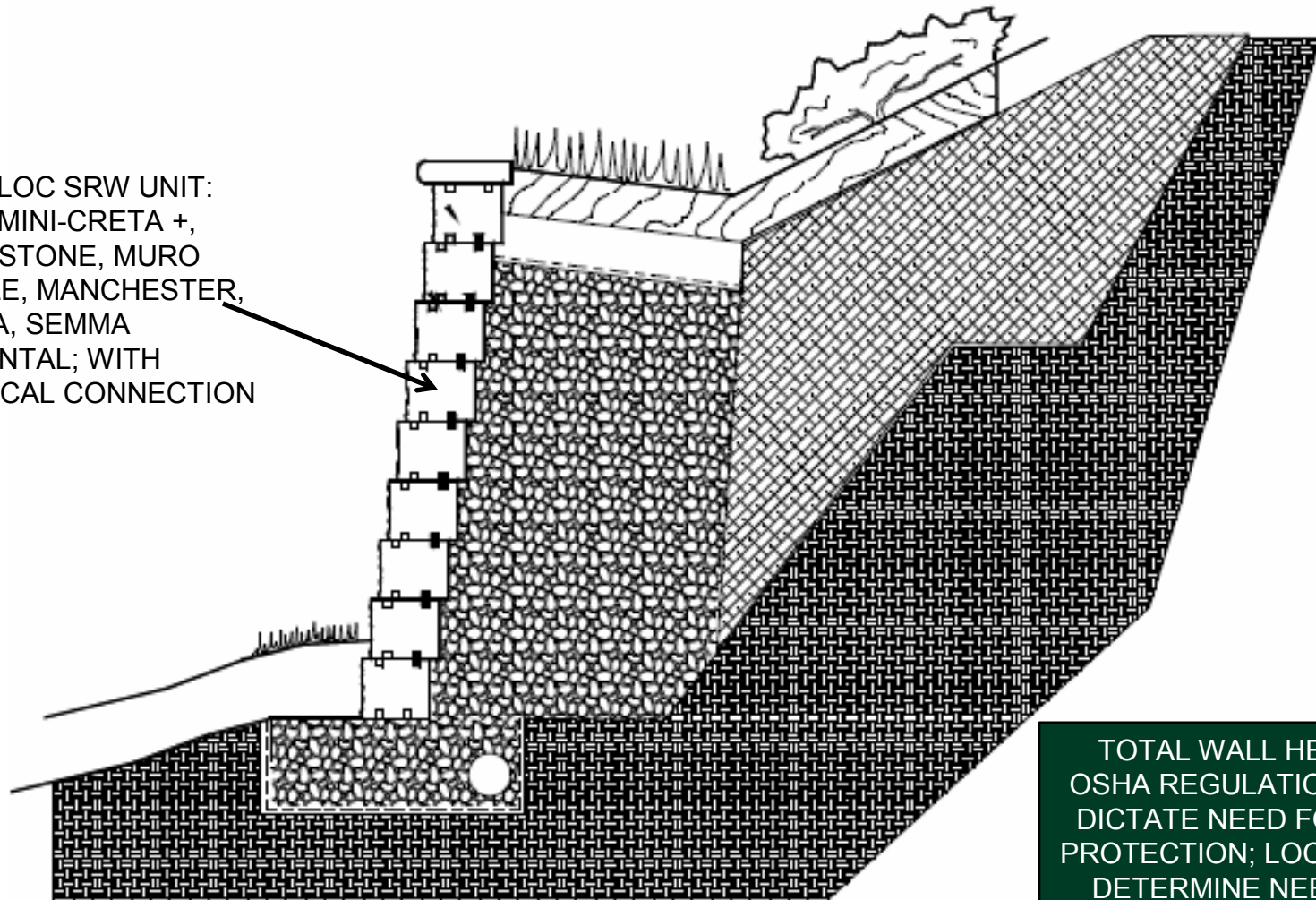
- BACKFILL
- CLEAN STONE (#57)
  - COMPACTION ZONE
  - FILTRATION ZONE
  - DRAINAGE ZONE
  - 36" WIDTH
- RECOMMENDED
- COMPACTED TO 95% SPD



# GRAVITY SRW



TECHO-BLOC SRW UNIT:  
ESCALA, MINI-CRETA +,  
QUARRY STONE, MURO  
NATURALE, MANCHESTER,  
SUPREMA, SEMMA  
MONUMENTAL; WITH  
MECHANICAL CONNECTION

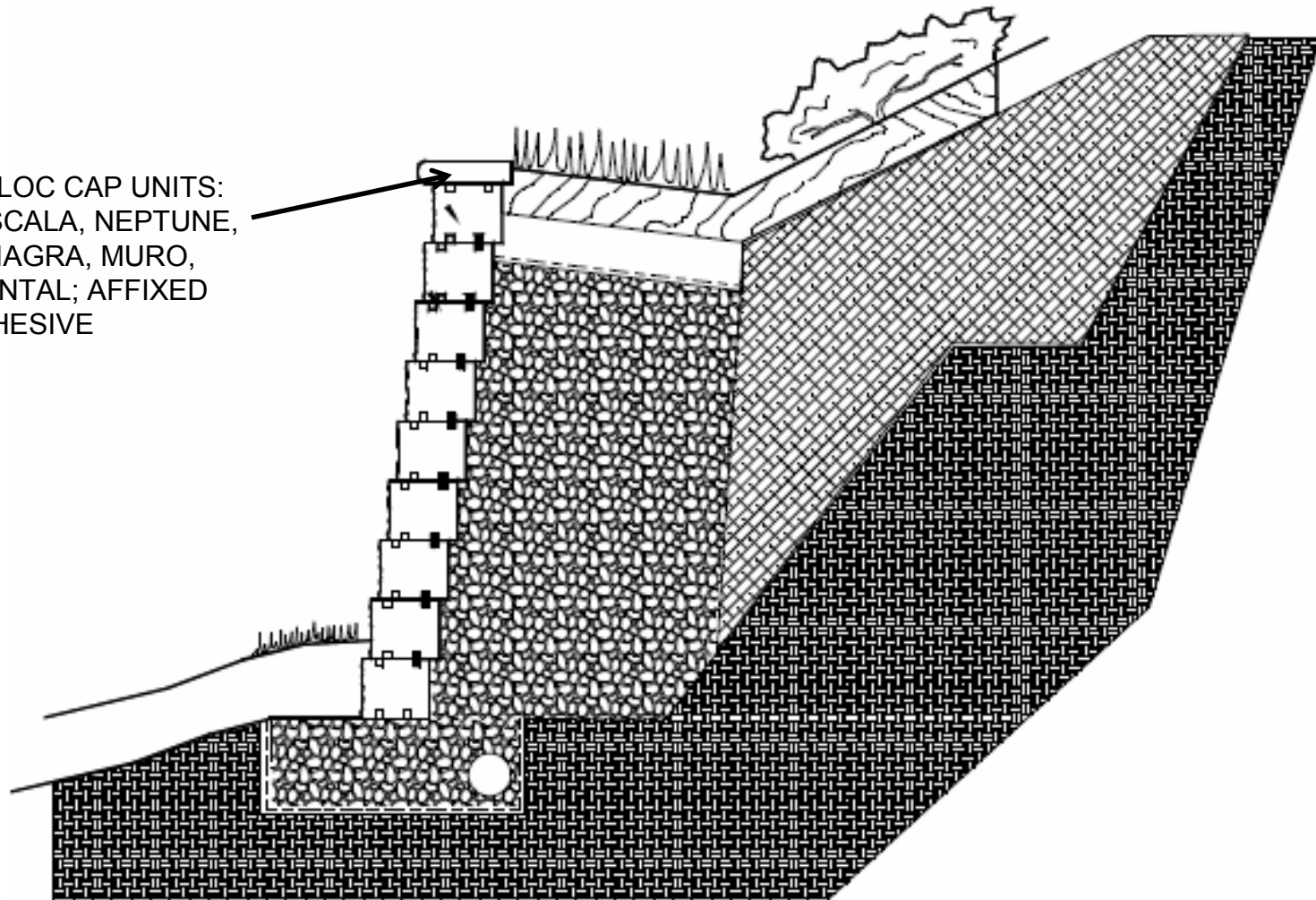


TOTAL WALL HEIGHT -  
OSHA REGULATIONS WILL  
DICTATE NEED FOR FALL  
PROTECTION; LOCAL CODE  
DETERMINE NEED FOR  
RAILINGS, ENGINEERING

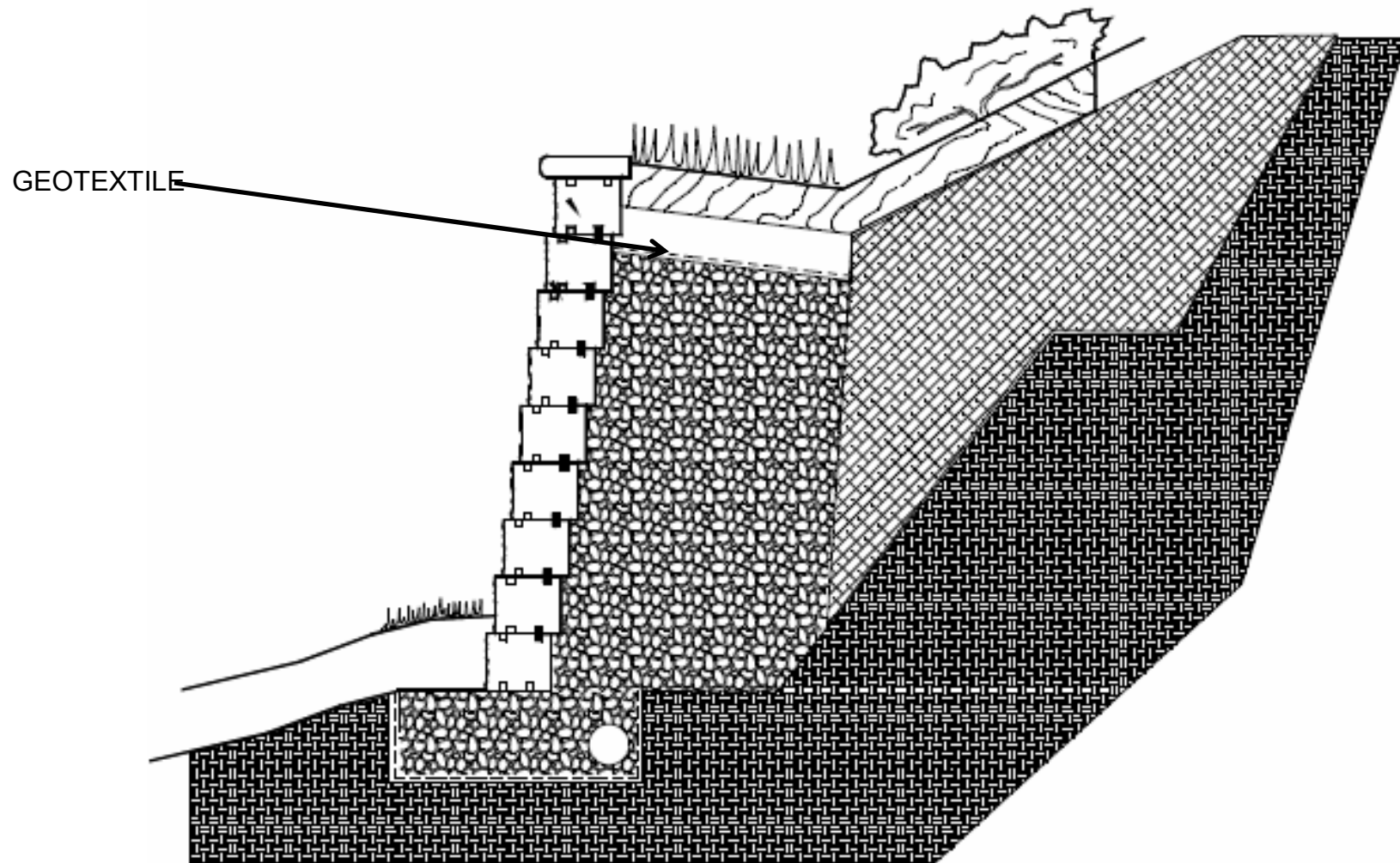
# GRAVITY SRW



TECHO-BLOC CAP UNITS:  
AGED, ESCALA, NEPTUNE,  
PRIMA, NIAGRA, MURO,  
MONUMENTAL; AFFIXED  
WITH ADHESIVE



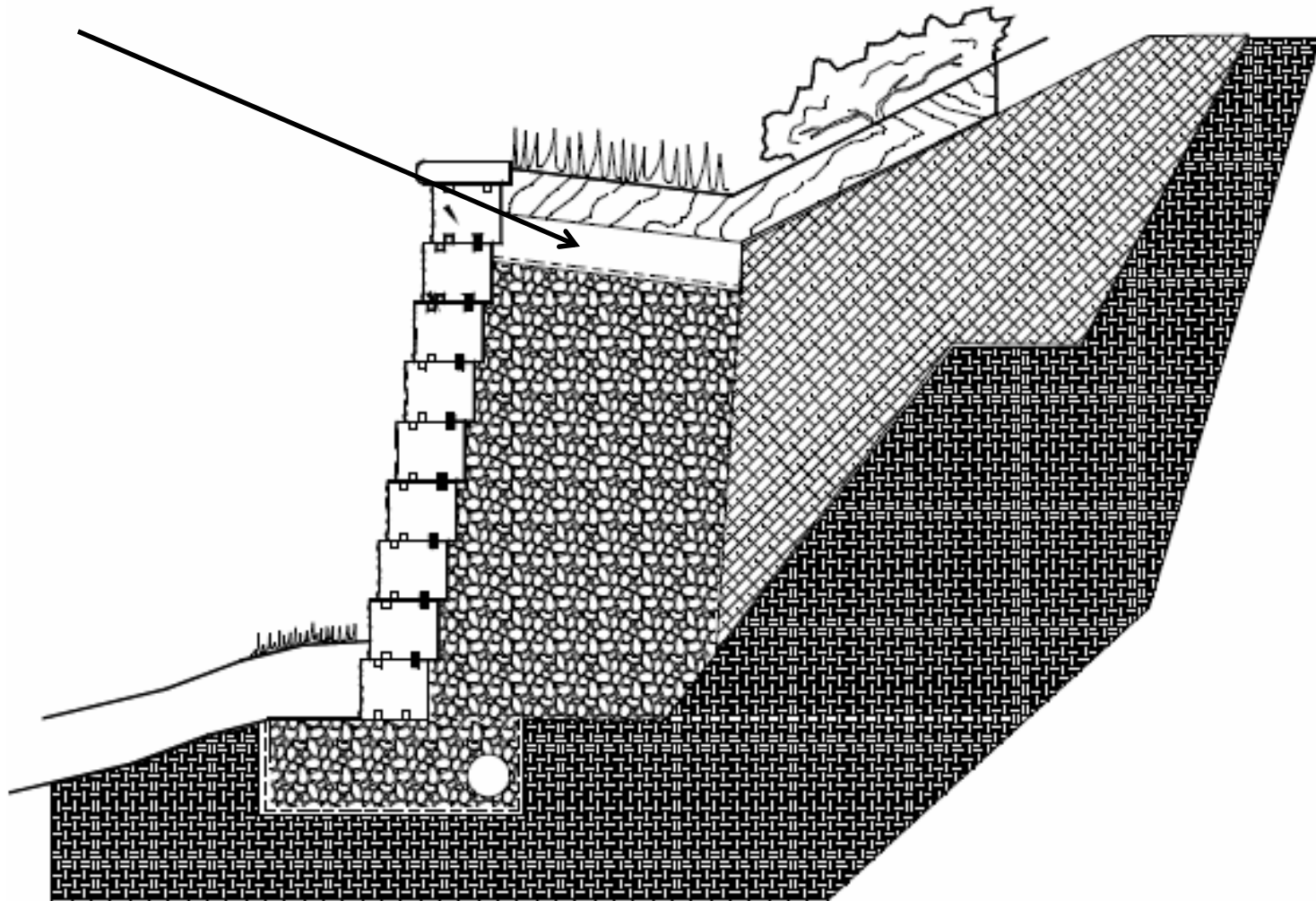
# GRAVITY SRW



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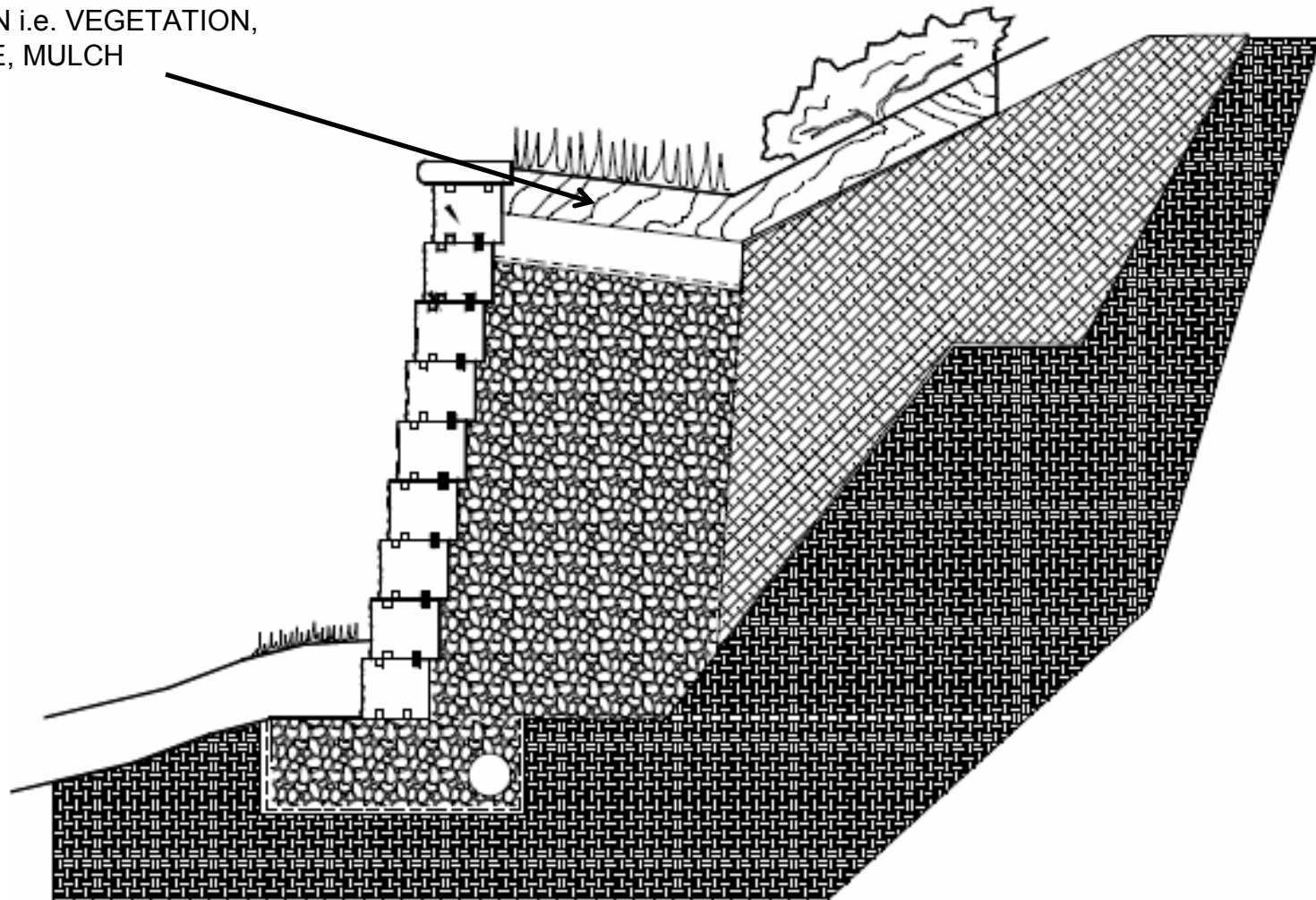
LOW PERMEABILITY SOIL CAP 8"  
MIN.



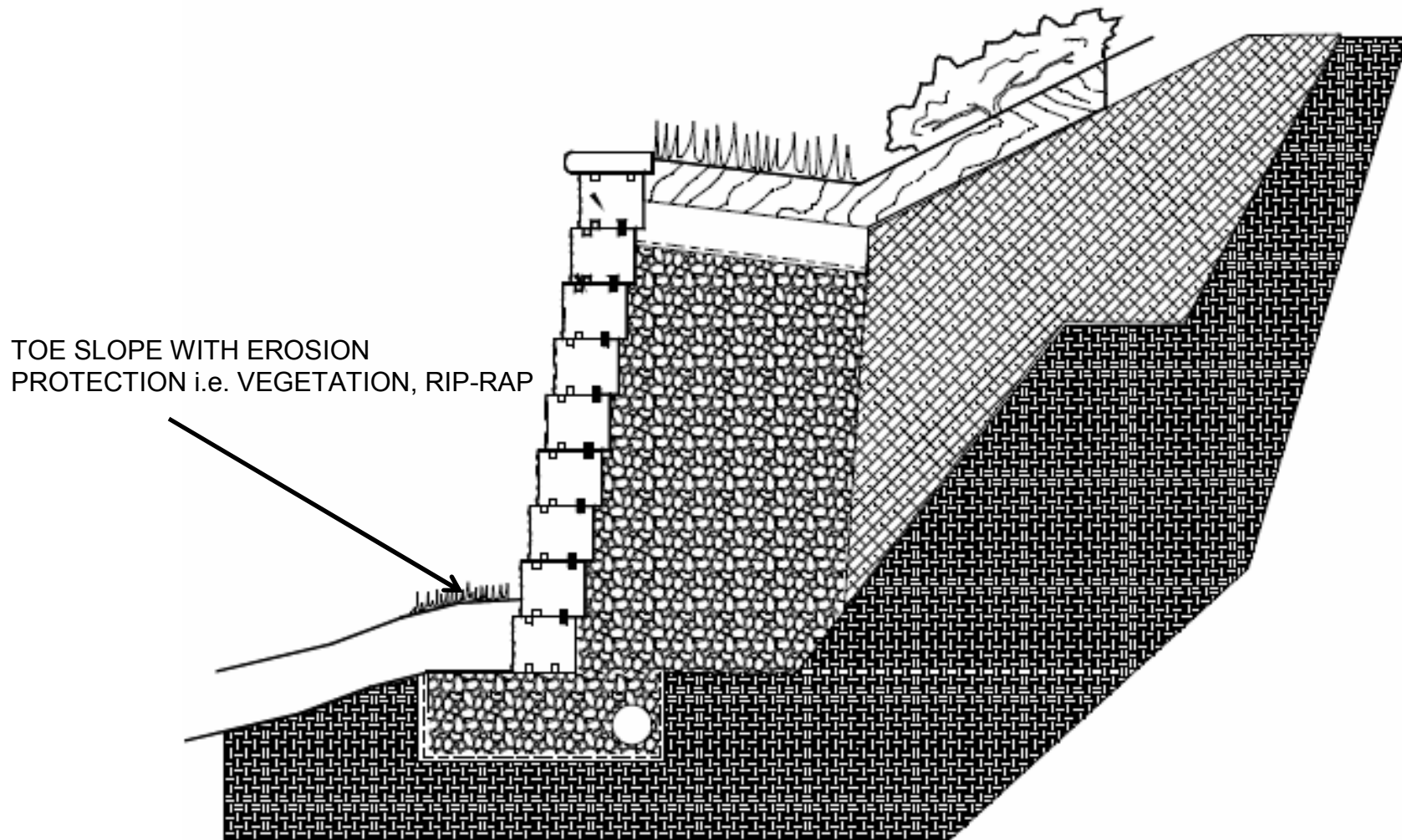
# GRAVITY SRW



TOPSOIL LAYER WITH EROSION  
PREVENTION i.e. VEGETATION,  
AGGREGATE, MULCH



# GRAVITY SRW

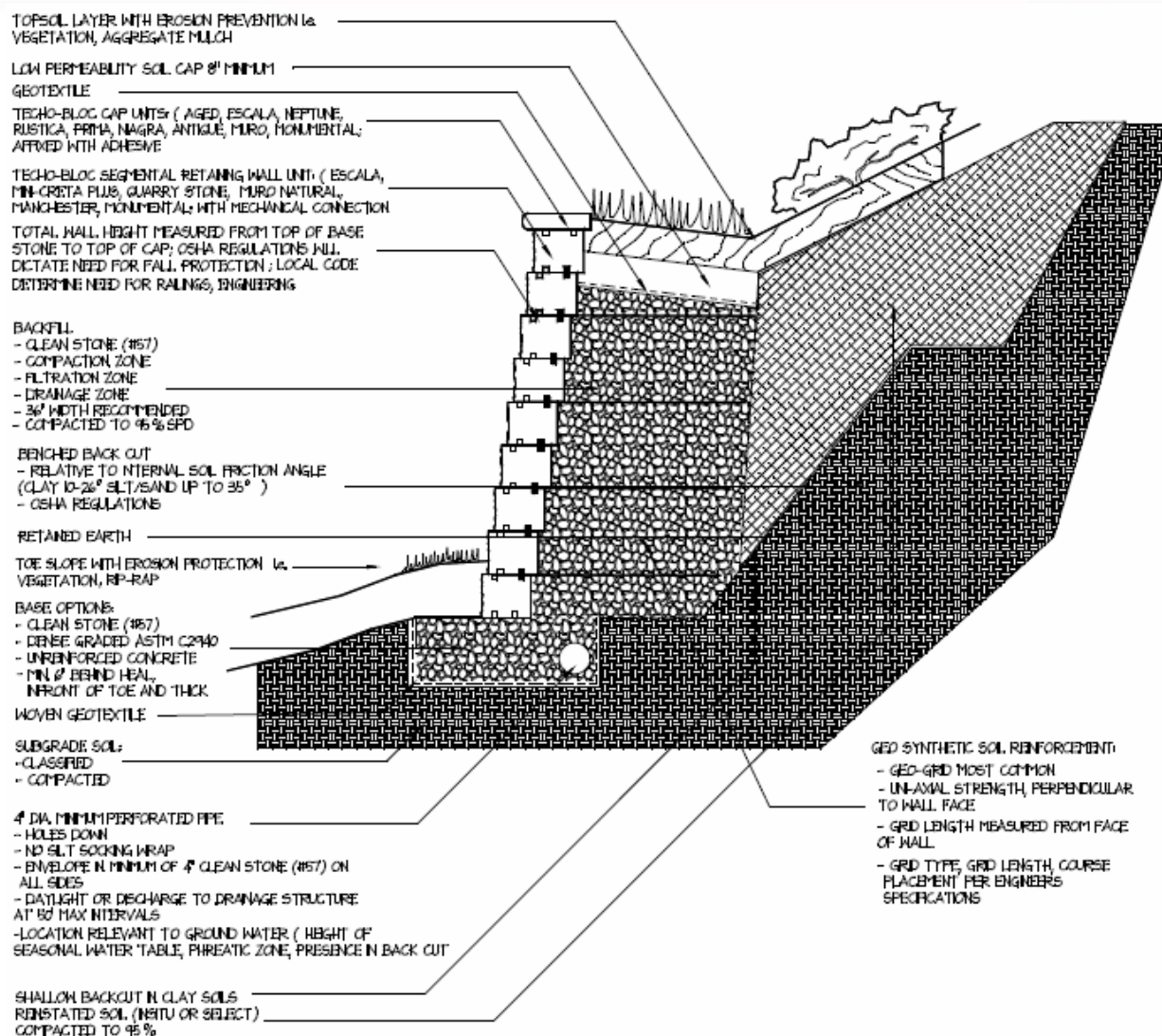


TOE SLOPE WITH EROSION  
PROTECTION i.e. VEGETATION, RIP-RAP

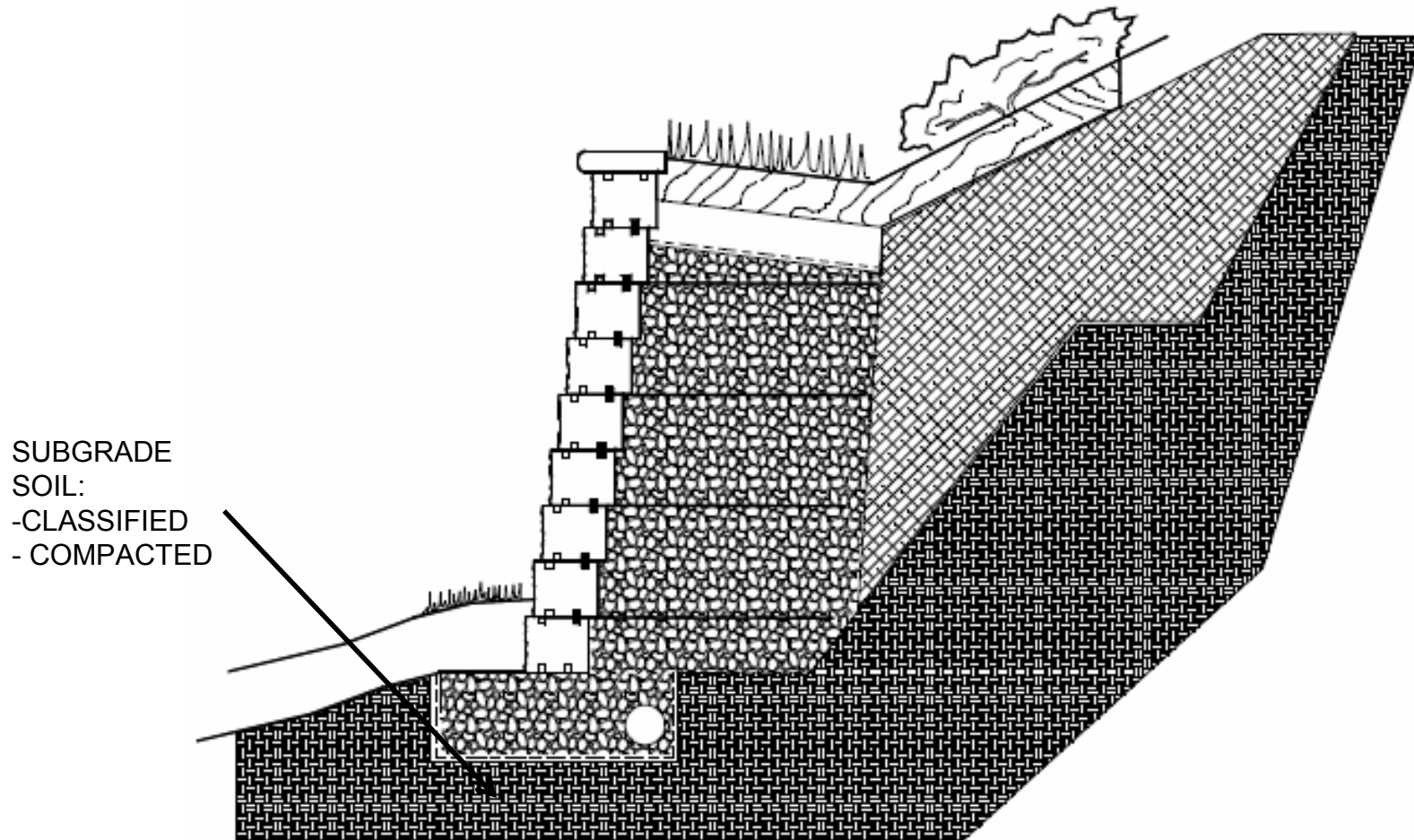


Soil Reinforced Walls

# SOIL REINFORCED SRW



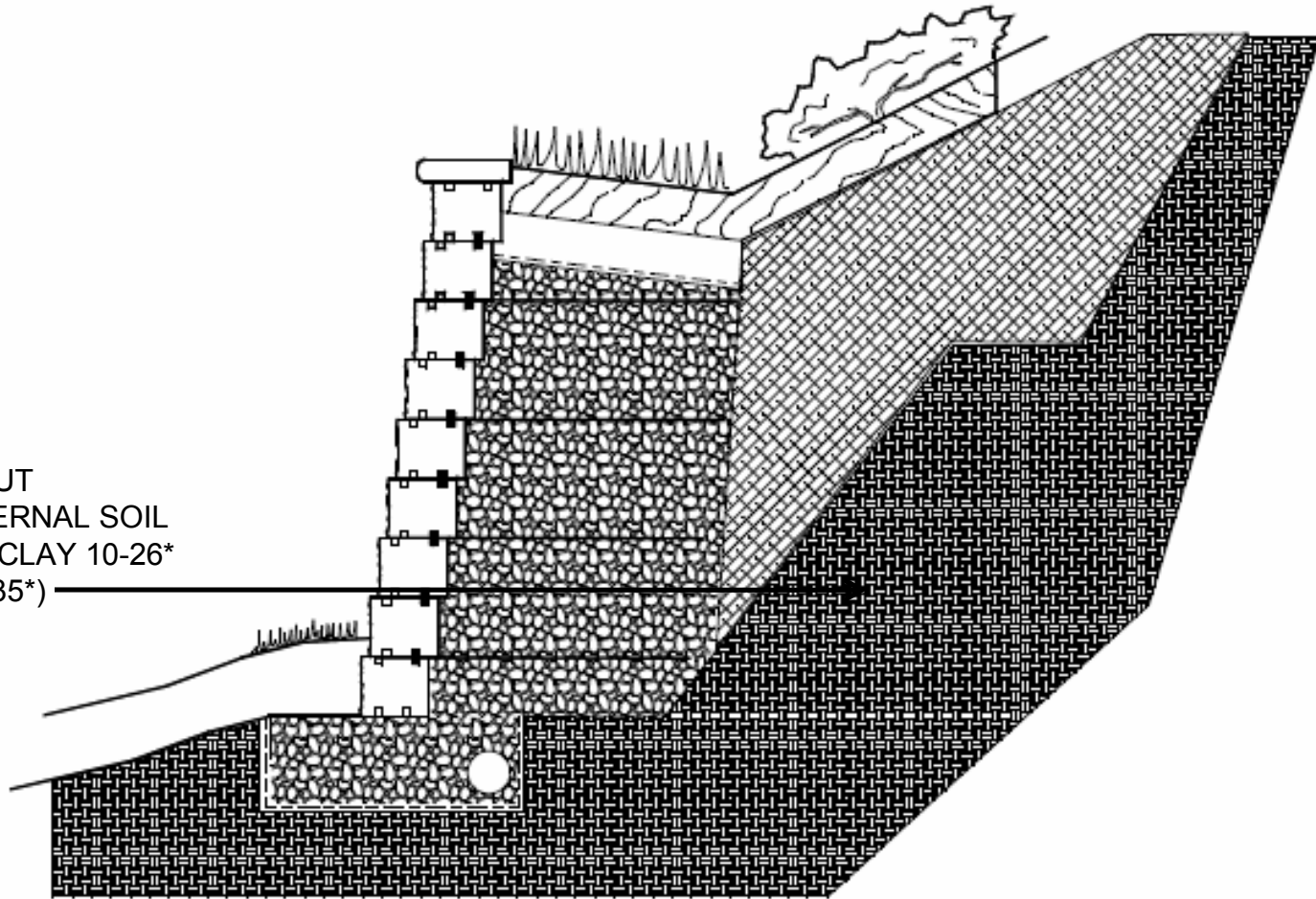
# SOIL REINFORCED SRW



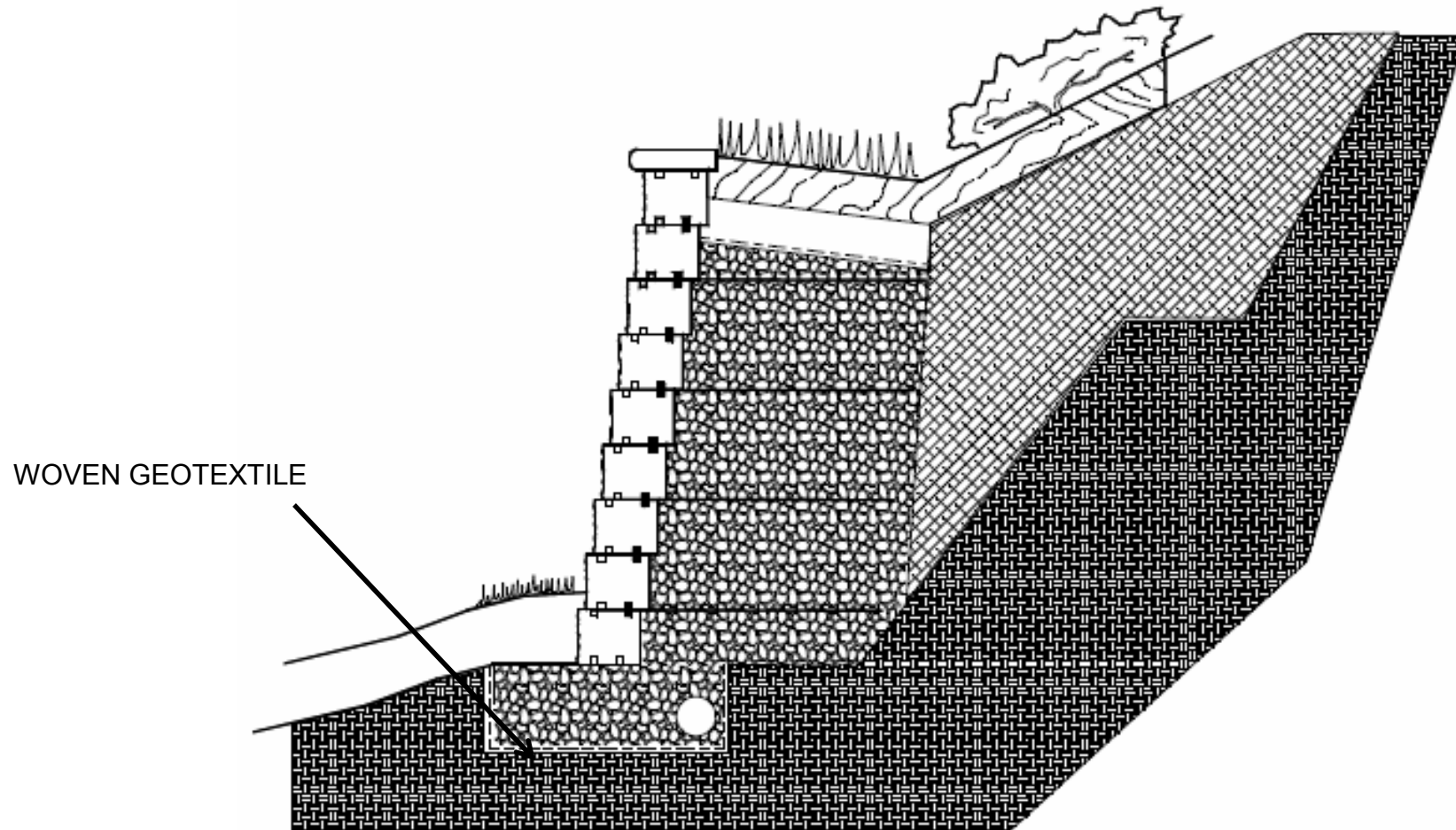
# SOIL REINFORCED SRW



BENCHED BACK CUT  
-RELATIVE TO INTERNAL SOIL  
FRICTION ANGLE (CLAY 10-26\*  
SILT/SAND UP TO 35\*)



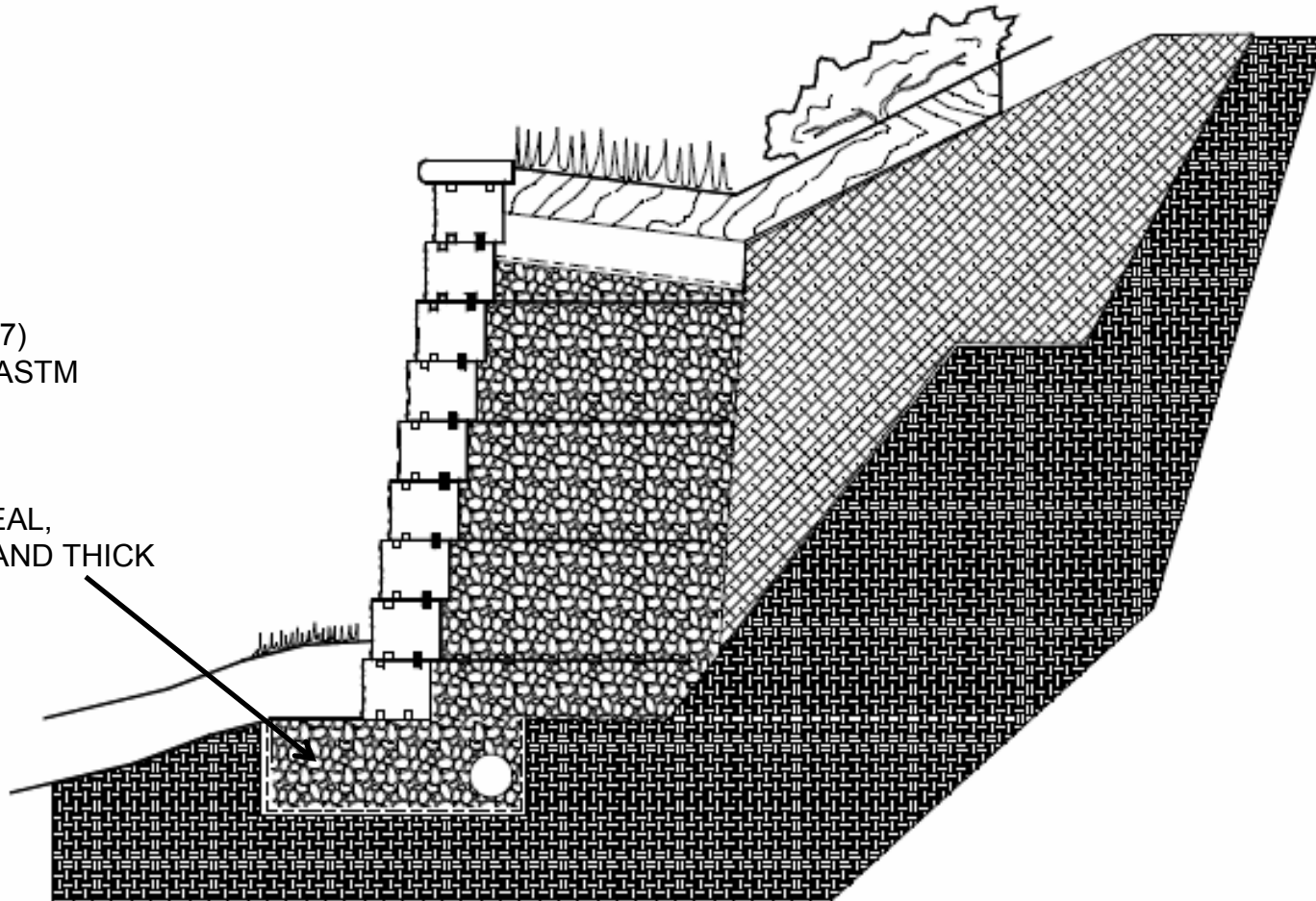
# SOIL REINFORCED SRW



# SOIL REINFORCED SRW



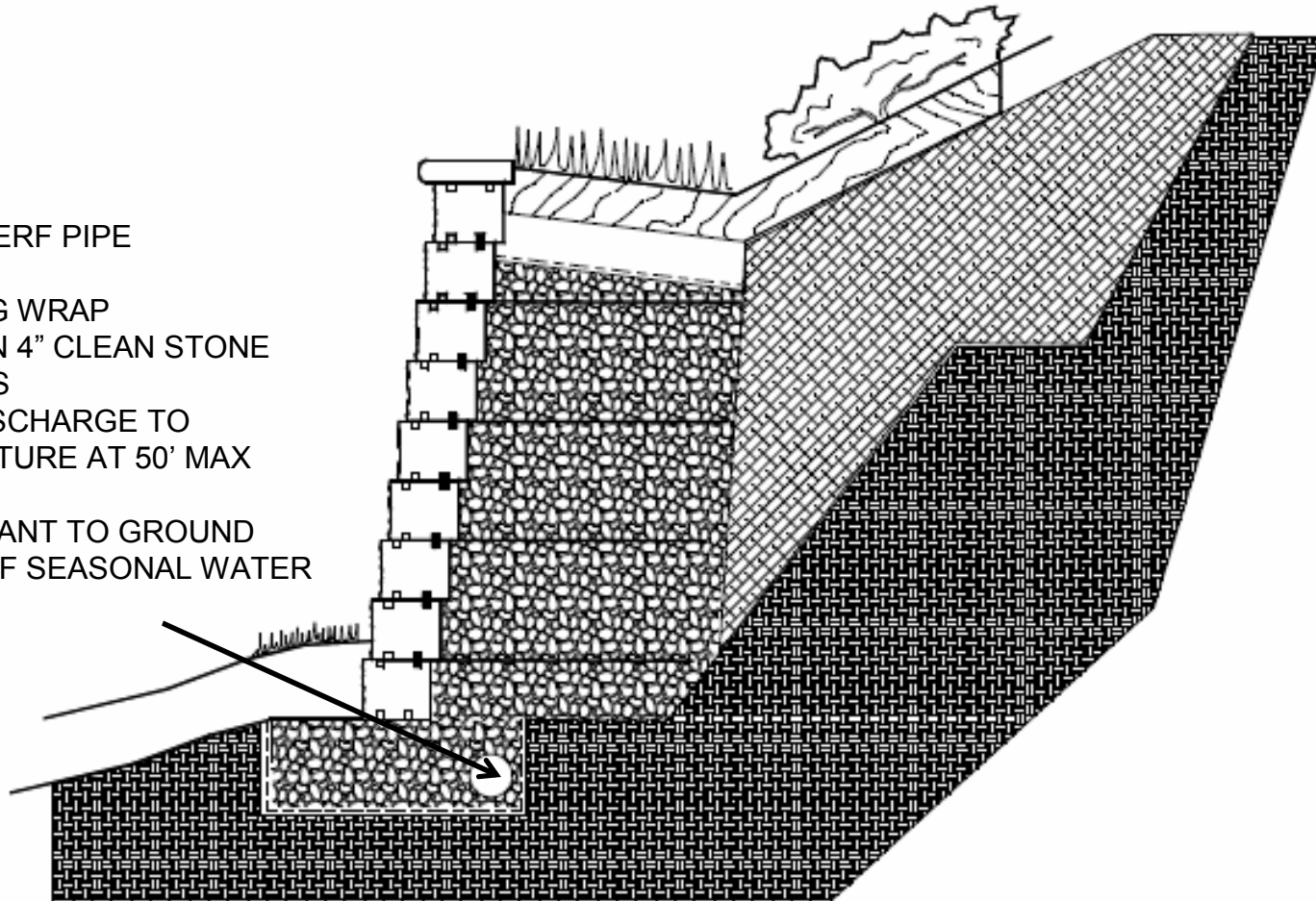
BASE OPTIONS  
- CLEAN STONE (#57)  
- DENSE GRADED ASTM  
C2940  
- UNREINFORCED  
CONCRETE  
- MIN 6" BEHIND HEAL,  
INFRONT OF TOE AND THICK



# SOIL REINFORCED SRW



- 4" DIA. MINIMUM PERF PIPE
- HOLES DOWN
- NO SILT SOCKING WRAP
- ENVELOPE IN MIN 4" CLEAN STONE (#57) ON ALL SIDES
- DAYLIGHT OR DISCHARGE TO DRAINAGE STRUCTURE AT 50' MAX INTERVALS
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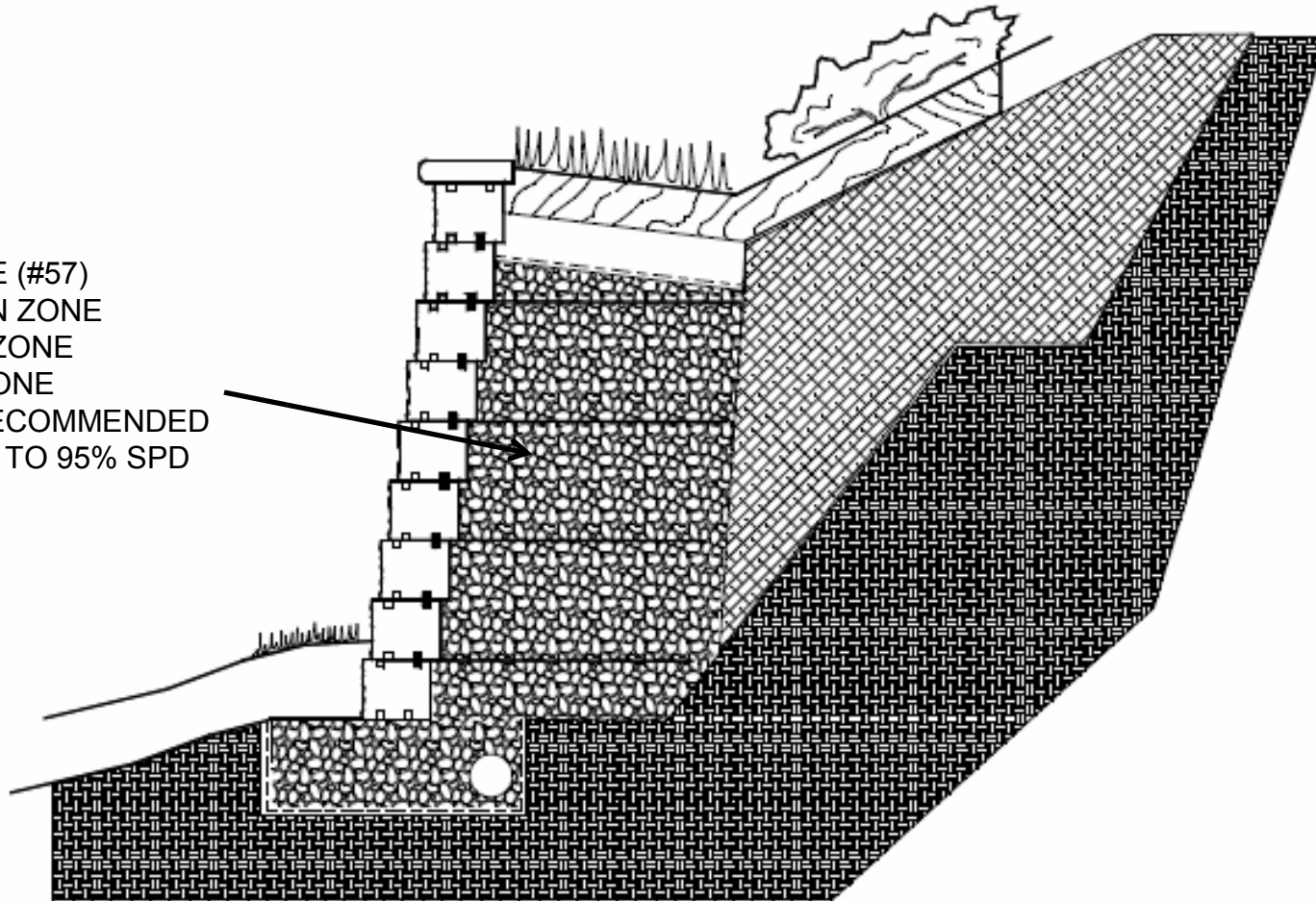


# SOIL REINFORCED SRW



## BACKFILL

- CLEAN STONE (#57)
- COMPACTION ZONE
- FILTRATION ZONE
- DRAINAGE ZONE
- 36" WIDTH RECOMMENDED
- COMPACTED TO 95% SPD

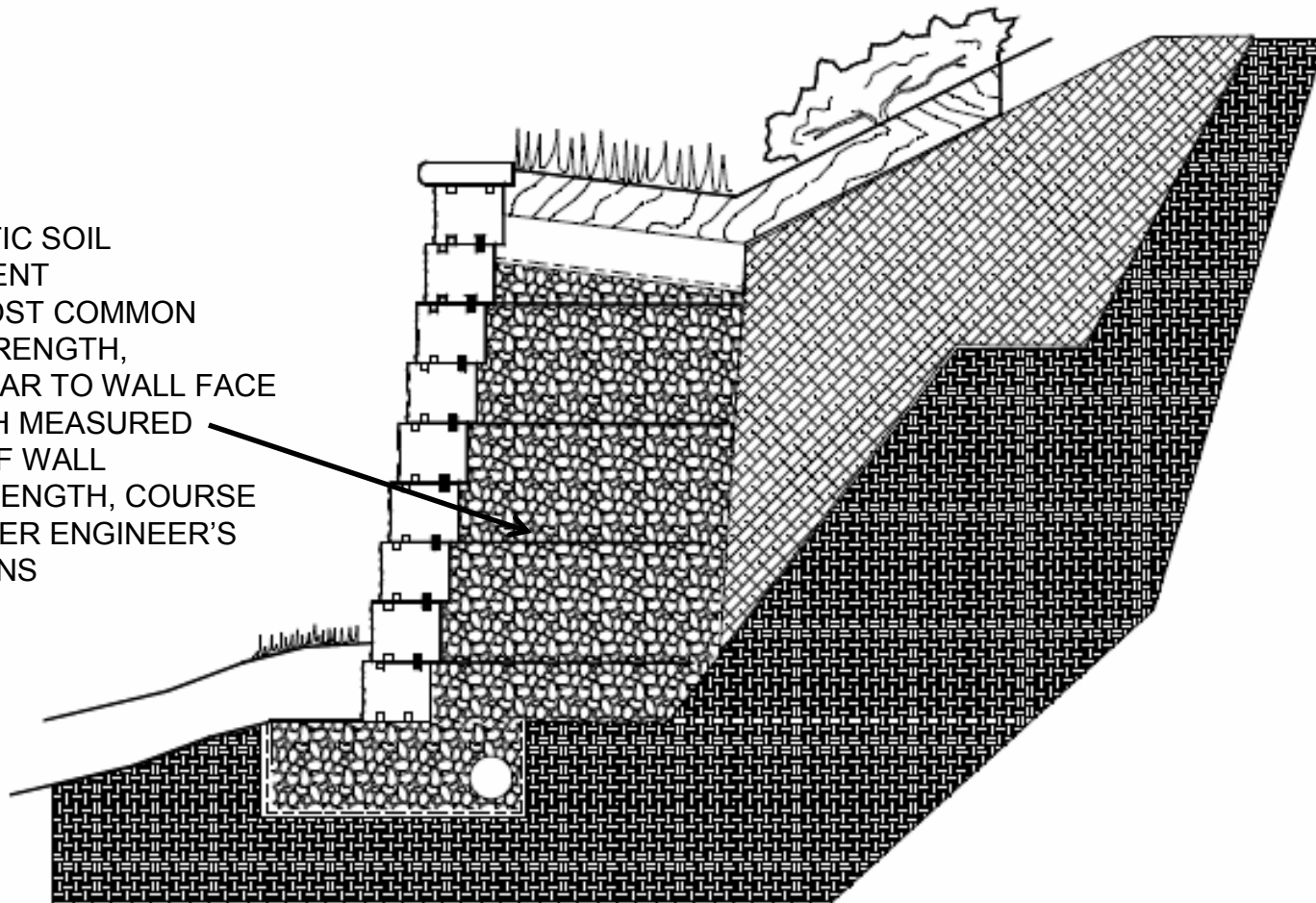


# SOIL REINFORCED SRW



## GEO SYNTHETIC SOIL REINFORCEMENT

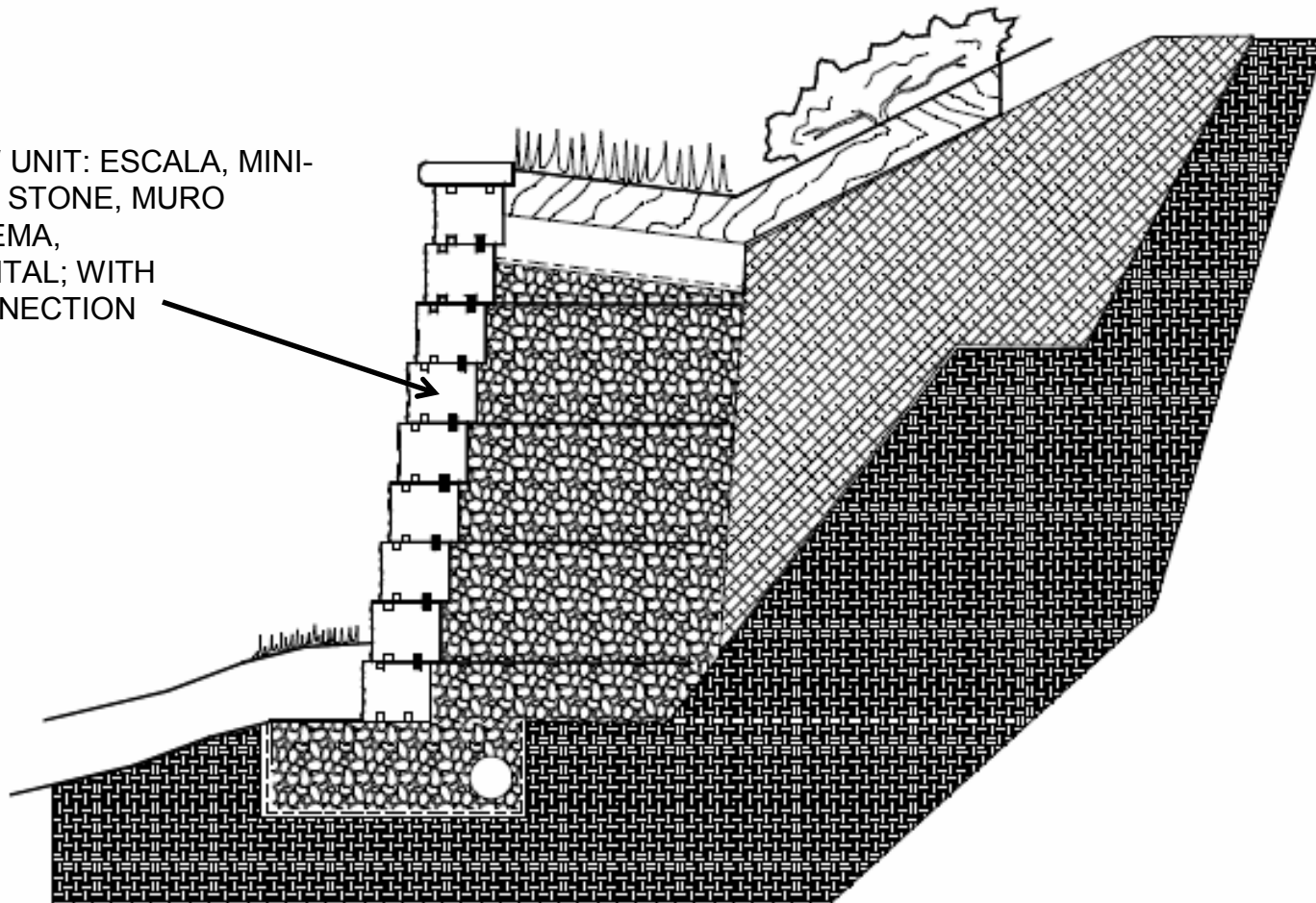
- GEO-GRID MOST COMMON
- UNI-AXIAL STRENGTH,  
PERPENDICULAR TO WALL FACE
- GRID LENGTH MEASURED  
FROM FACE OF WALL
- GRID TYPE, LENGTH, COURSE  
PLACEMENT PER ENGINEER'S  
SPECIFICATIONS



# SOIL REINFORCED SRW



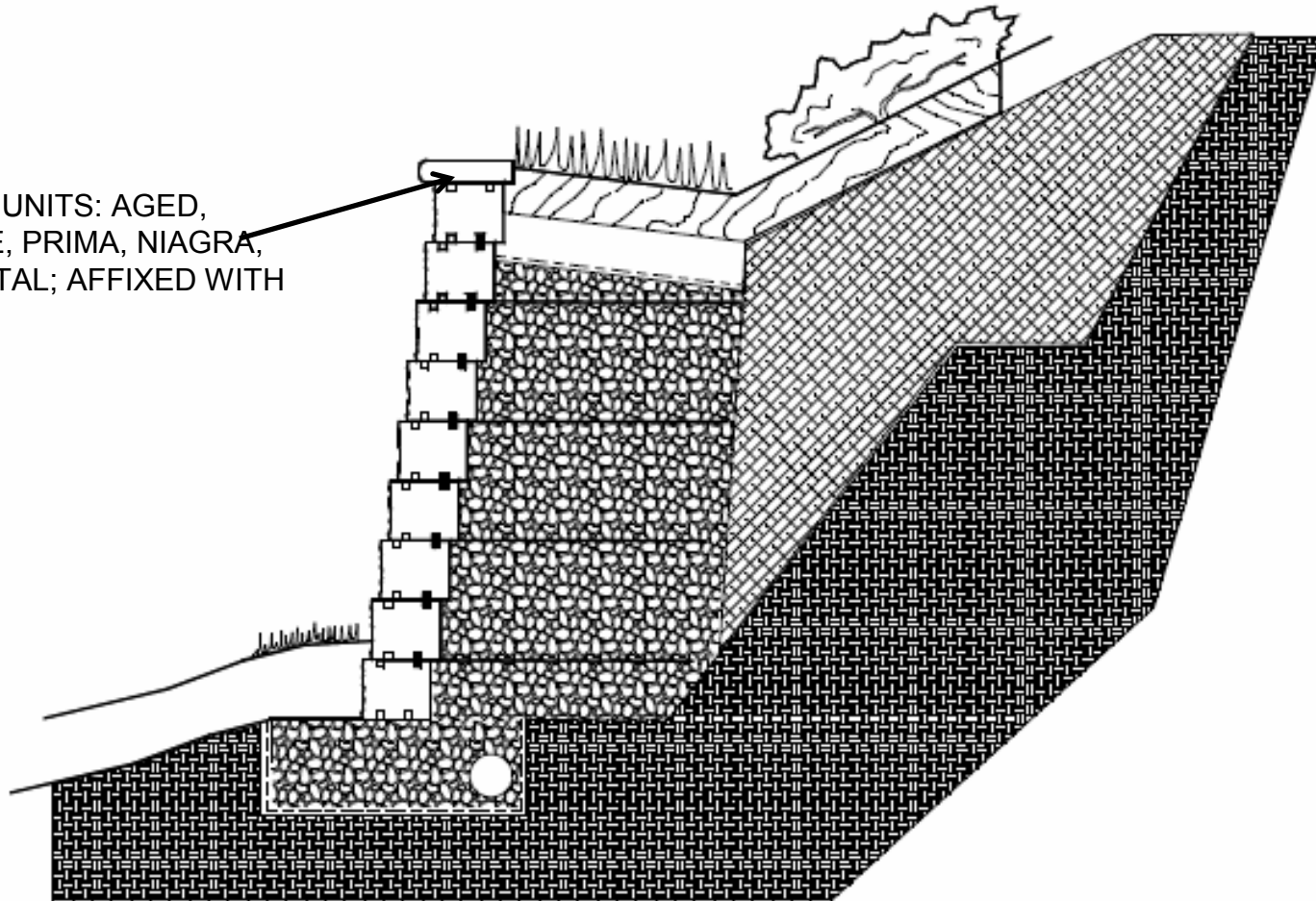
TECHO-BLOC SRW UNIT: ESCALA, MINI-CRETA +, QUARRY STONE, MURO NATURALE, SUPREMA, SEMMA, MONUMENTAL; WITH MECHANICAL CONNECTION



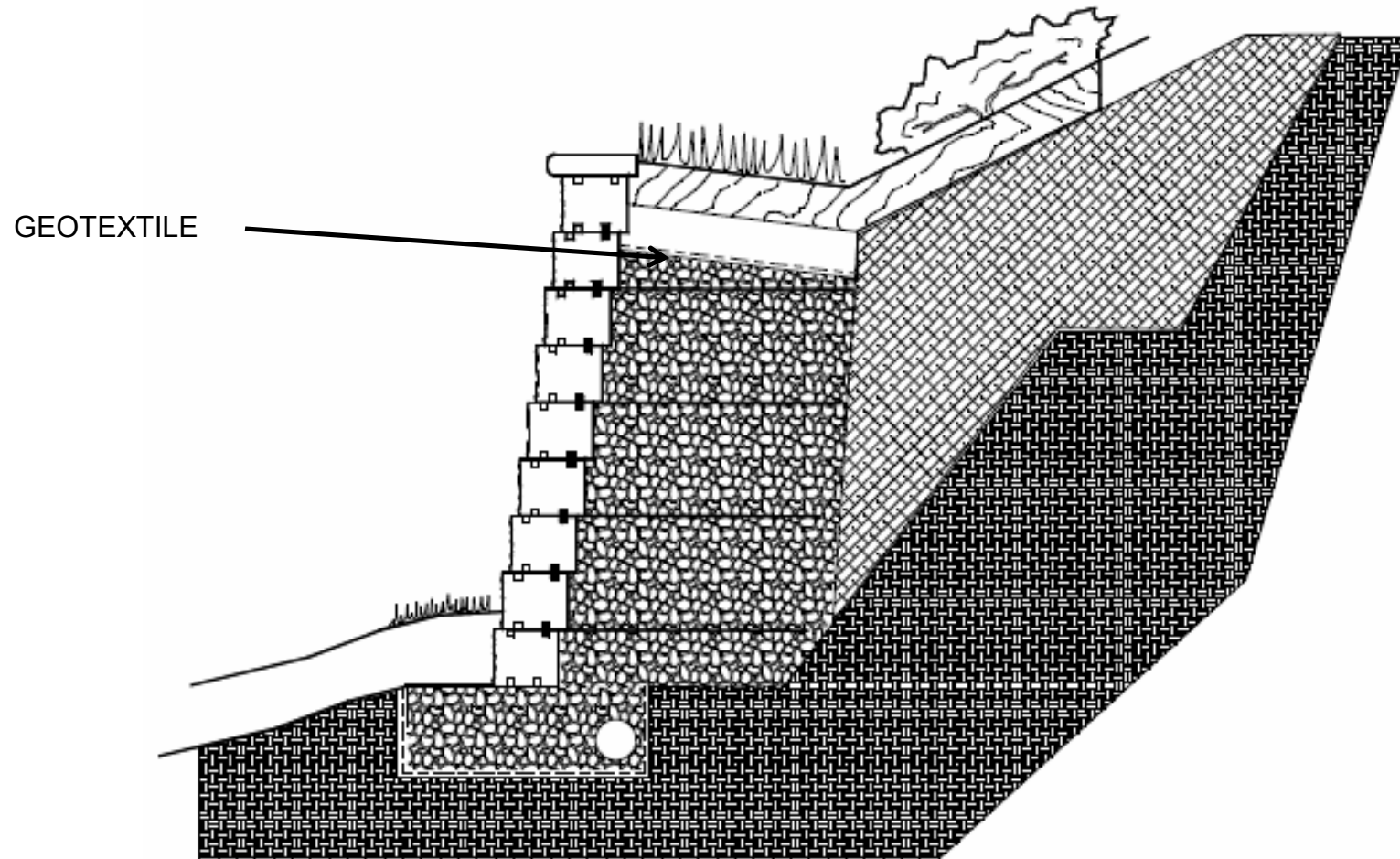
# SOIL REINFORCED SRW



TECHO-BLOC CAP UNITS: AGED, ESCALA, NEPTUNE, PRIMA, NIAGRA, MURO, MONUMENTAL; AFFIXED WITH ADHESIVE



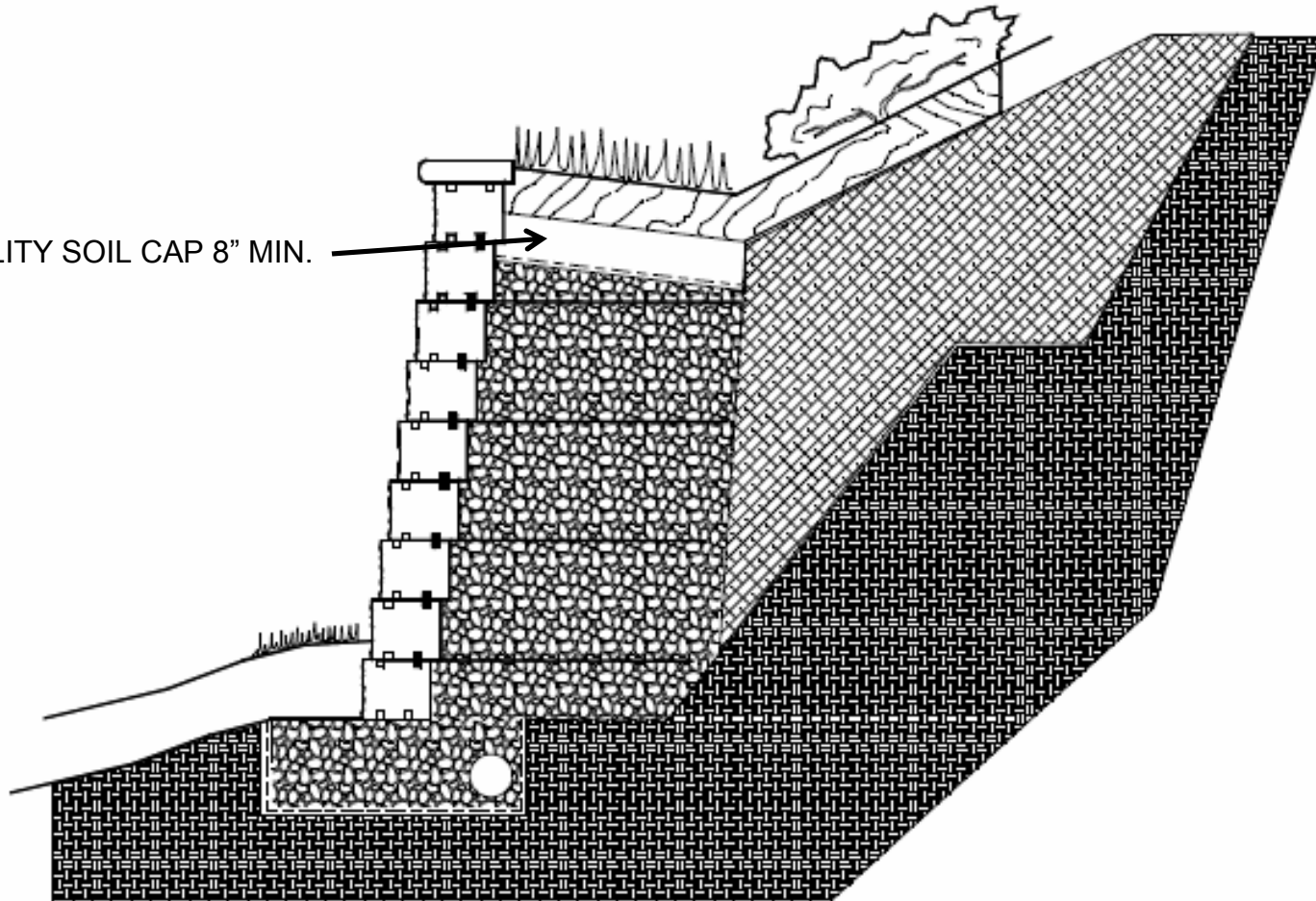
# SOIL REINFORCED SRW



# SOIL REINFORCED SRW



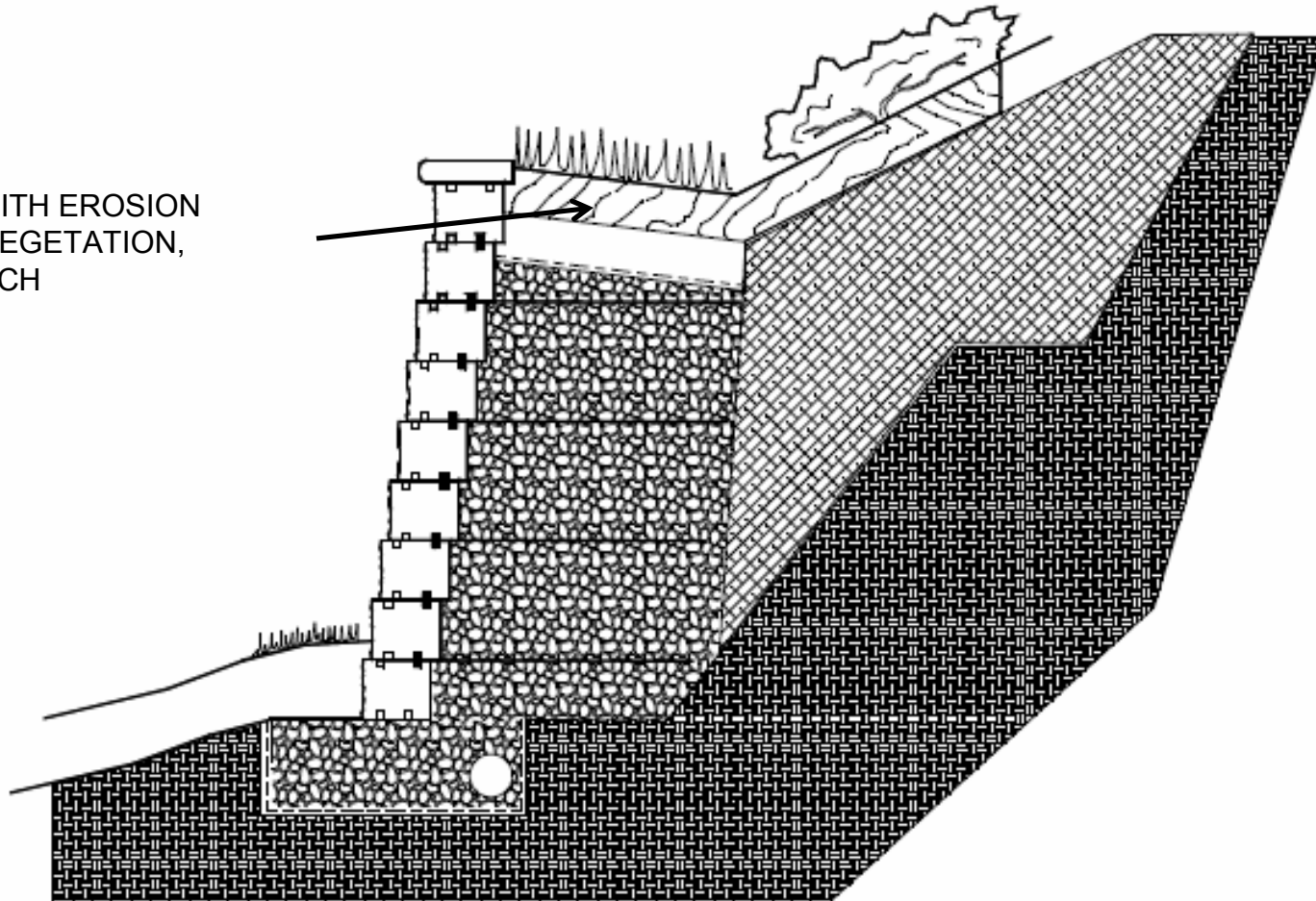
LOW PERMEABILITY SOIL CAP 8" MIN.



# SOIL REINFORCED SRW



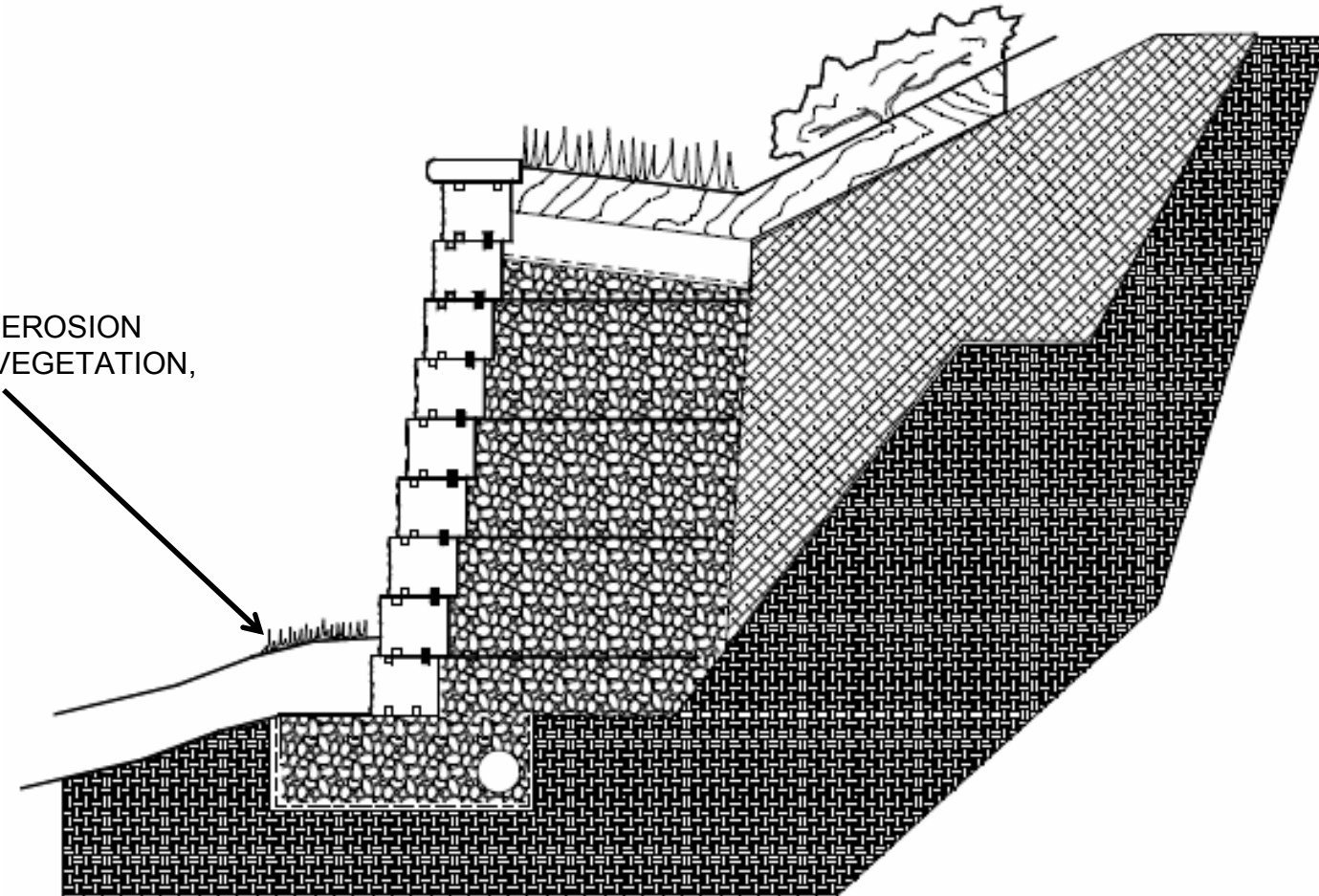
TOPSOIL LAYER WITH EROSION  
PREVENTION i.e. VEGETATION,  
AGGREGATE, MULCH



# SOIL REINFORCED SRW



TOE SLOPE WITH EROSION  
PROTECTION i.e. VEGETATION,  
RIP-RAP





## Performance Factors

# Performance factors



- Influencing Maximum Wall Height
  - Soil fill type
  - Geometry
    - Top and Toe Slopes
    - Tiers
  - Surcharge load

# Performance factors



- Granular Soil (Gravel)
  - Lower lateral load
  - Higher strength
    - Shear strength
    - High friction angle
  - High permeability
    - Greater water flow
  - Easier to compact
    - Less sensitive to water
    - Lower compaction energy
- Fine-grained Soil (Clay)
  - Higher lateral load
  - Lower strength
    - Low friction angle
  - Low permeability
    - Lower water flow
    - Impart water load
  - More difficult to compact
    - More sensitive to water
    - Greater compaction energy

# Performance factors



- Top slope
  - Increase lateral load
    - Reduces factor of safety against sliding & overturning
    - Increases foundation pressure
  - Directs surface water towards wall
    - Erosion
    - Water seepage
- Effects
  - Need more weight to resist
    - Wider, heavier units
    - Longer, stronger reinforcements
  - Water Collection systems
    - Drainage swales
    - Erosion resistant vegetation

# Performance factors



- Toe slope
  - Decreases foundation stability
  - Increases potential for global instability
- Effects
  - Wider units or longer reinforcement
  - Deeper wall burial
  - Foundation treatment

# Performance



- Load
  - Dead Load
    - Structures
    - Foundations
  - Live Load
    - Pedestrian
    - Vehicle
  - Snow or other temporary load (fill surcharge)
  - Earth
  - Water



Tiered Walls

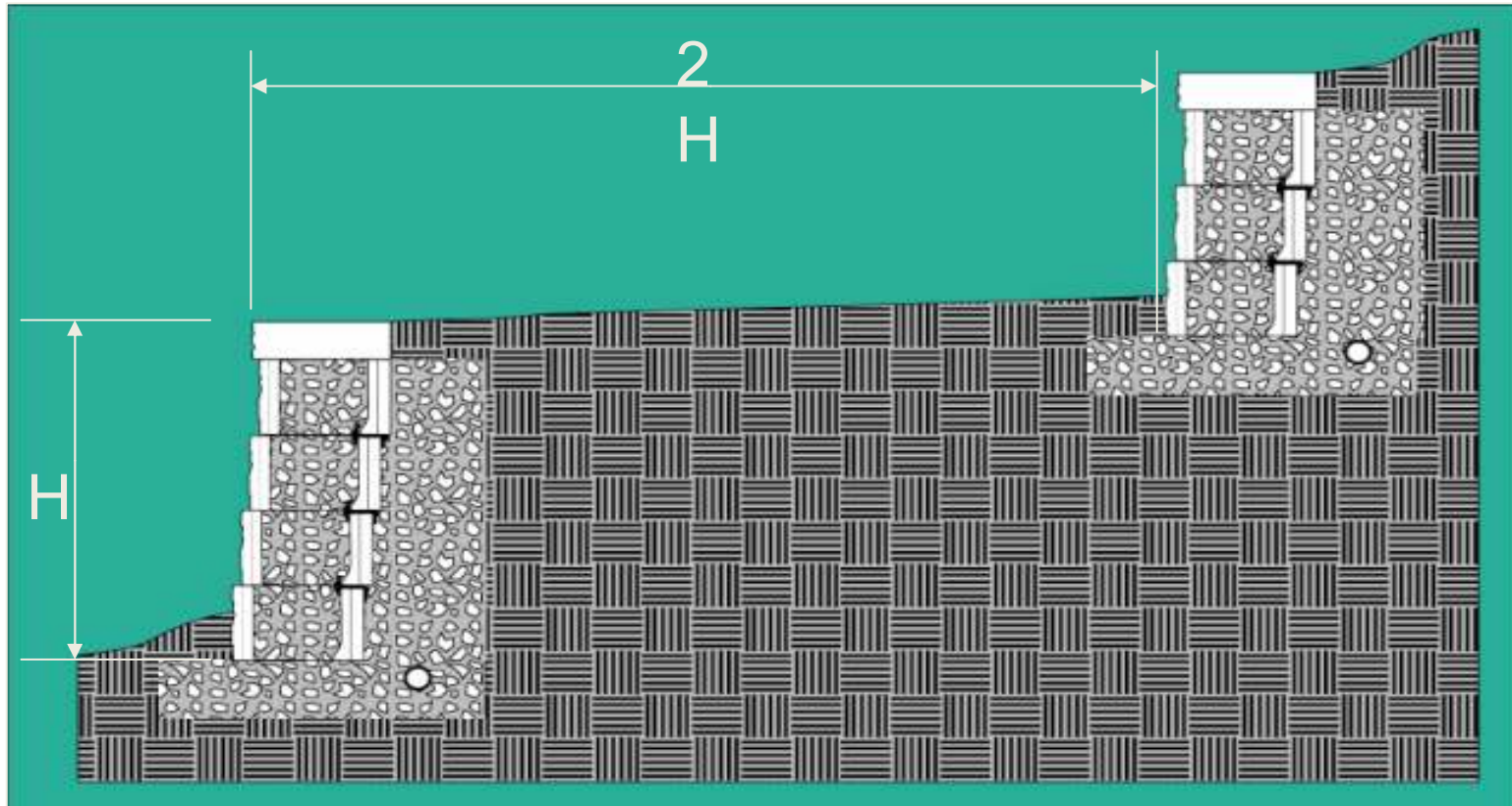
# Performance factors



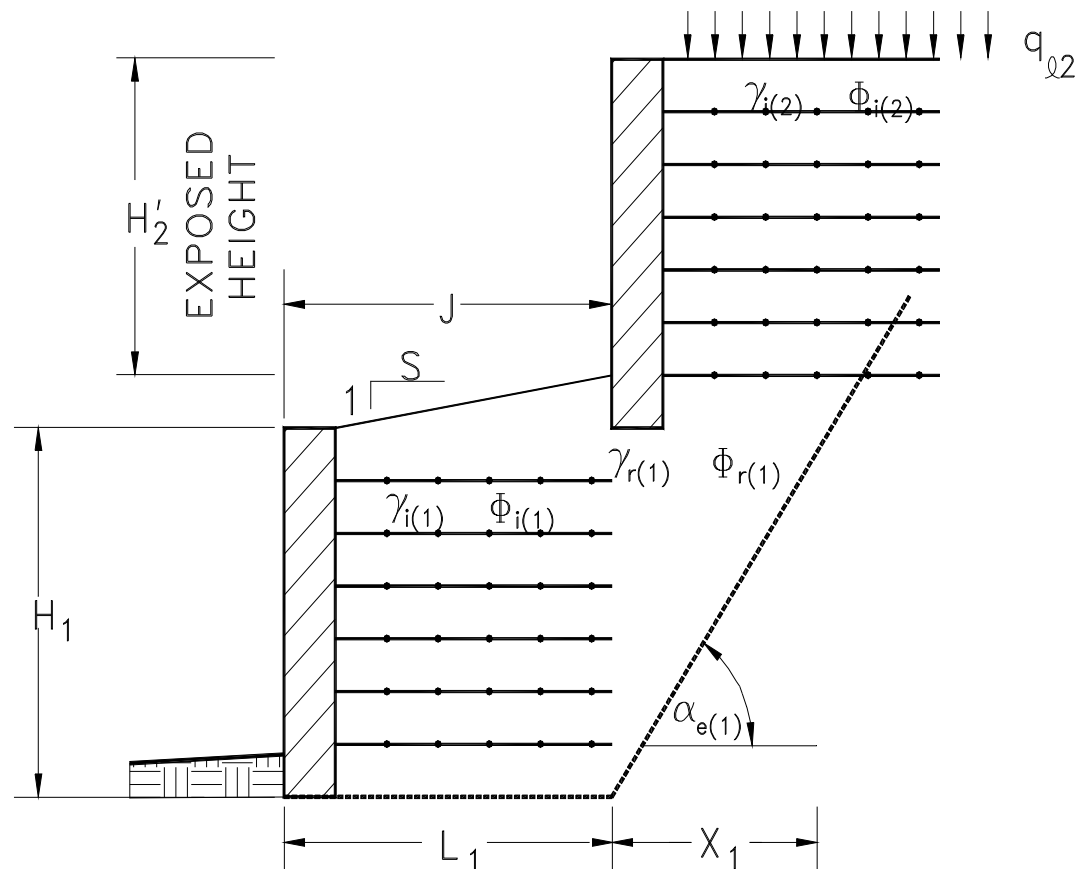
## Tiered walls

- Increase load on lower tiers
- Reduce global stability
- Reduce constructible wall heights
- Increase soil reinforcement requirements length and/or strength

# Performance



# Performance



# Performance



- Tiered Wall Guidelines
  - Combined height  $< 6$  ft.
  - Distance between walls  $> 2 \times$  Height of lower wall
    - Local stability not influenced by adjacent wall
  - Combined height  $> 6$  ft
  - Distance between walls  $< 2xH$ 
    - Engineer evaluates stability of tiered walls
    - Adjacent walls influence each other



SRW Codes

# Codes & Specs



- Block Tolerances
  - Dimensional
  - Absorbtion
  - PSI
  - Freeze / thaw

# Codes & Specs



All interlocking pavers manufactured by Techo-Bloc follow strict regulations in their components, being sand, stone, cement and color. They are all vigorously tested for a maximum quality control. Techo-Bloc pavers are manufactured with zero slump concrete and cured in a controlled environment. All pavers must meet the following norms ASTM-C936, CSA (A231.2-M95) and the NQ.2624-120/87 which is the most demanding world wide and recognized by the experts.

|                                       | ASTM-C936                          | Techo-Bloc                         |
|---------------------------------------|------------------------------------|------------------------------------|
| Compressive strength                  | 8000 psi at 28 days                | minimum 9000 psi at 28 days        |
| Durability to freeze thaw cycles      | total mass loss no greater than 1% | total mass loss no greater than 1% |
| Absorption                            | lower than 5%                      | lower than 3 %                     |
| Dimension tolerance of the paver norm | +/- 3 mm                           | +/-3 mm                            |
| Other surfaces                        | -1 mm to +3 mm                     | -1 mm to +2 mm                     |

All pavers manufactured by Techo-Bloc meet the ASTM-C936 norm.

# Codes & Specs



## Retaining Wall Height Chart

### MAXIMUM HEIGHT FOR WALL WITHOUT THE USE OF GEOGRID (in optimal conditions)

| Type of wall               | Max height inclined | Max height straight | Degrees |
|----------------------------|---------------------|---------------------|---------|
| Garden Walls Econo         | 30" (75 cm)         |                     | 13,2    |
| Escala                     | 3' (90 cm)          | 30" (75 cm)         | 4,4     |
| Creta                      | 3' (90 cm)          | 30" (75 cm)         | 5,5     |
| Mini-Creta Plus 3"         | 3' (90 cm)          | 30" (75 cm)         | 5,3     |
| Mini-Creta Plus 6"         | 3' (90 cm)          | 30" (75 cm)         | 5,3     |
| Quarry Stone 100 mm        | 3' (90 cm)          | 30" (75 cm)         | 4,0     |
| Quarry Stone 200 mm        | 3' (90 cm)          | 30" (75 cm)         | 4,0     |
| Slope and Split Face Block | 3'5 (1,1 m)         |                     | 14,5    |
| Mini-Blok                  | 3' (90 cm)          | 30" (75 cm)         | 5,3     |
| Blok Monumental            | 10' (3 m)           | 7' (2,13 m)         | 10,8    |
| Suprema                    | 32" (81 cm)         | 32" (81 cm)         | 4,5     |

**Note:** The maximum heights presented in this table are in relation to the construction of walls without the use of geogrid. In order to achieve greater heights, geogrid will be necessary, please fill in the Wall Design Form before beginning your project.

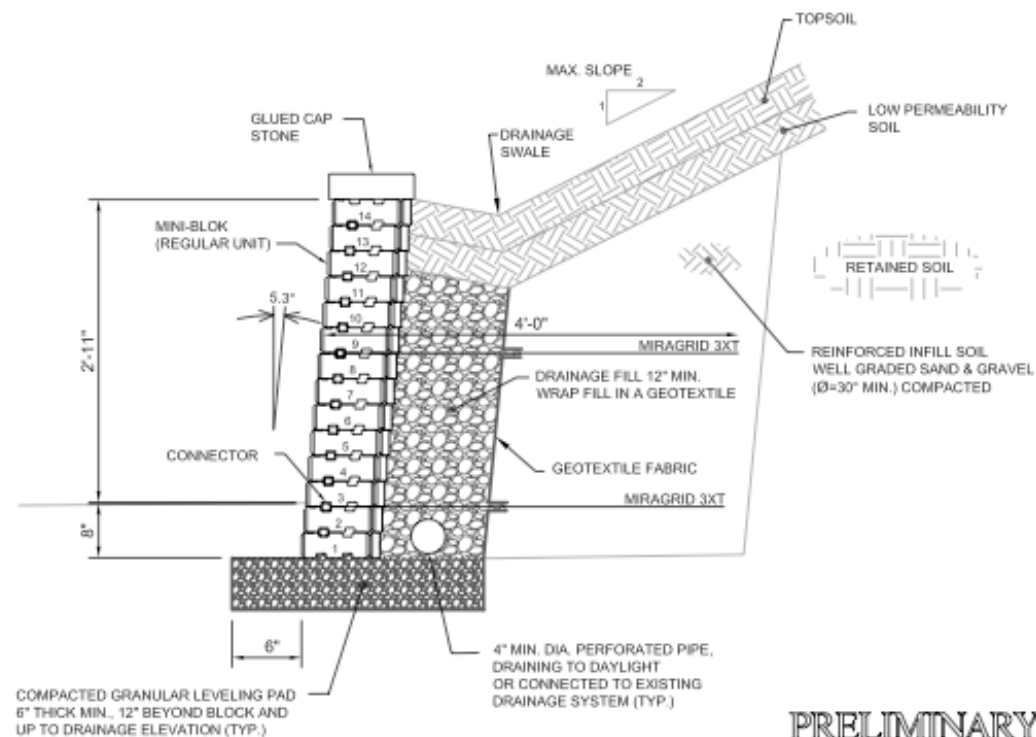
**Note:** The Mini-Creta Plus 3" and 6", Mini-Blok, Creta, Monumental Blok and Quarry Stone 100 mm and 200 mm offer the possibility of building a straight or inclined wall, a staircase, a pillar and inward or outward curves with the right application of the P.V.C. inserts.

# Codes & Specs



KOONDEL

## SECTION 1



**PRELIMINARY**

FOR ESTIMATING PURPOSES ONLY

# Codes & Specs



- OSHA
  - > 6' → fall protection
    - Safety lines and harnesses
    - Safety nets and fencing systems
    - Evaluate feasibility of each
  - PPE
- International and Local Bldg codes
  - > 4' → requires engineering
- CT State
  - > 3' requires permit

# Codes & Specs



- Compaction
  - Responsibility
  - Foundation
  - Infill soils
  - Equipment





SRW Trends

# Trends



- Market Trends
  - Tumbled Facing Systems
  - Installer education
  - Utilization with other products
    - Pavers
    - Natural stone
    - articulating concrete block revetments

# Trends



# Trends



# Thank you



Thank you for coming.

Please visit

**[www.Techo-Bloc.com](http://www.Techo-Bloc.com)**

For latest training videos and documents.